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Vol. XI. Part 1. 10th January, 1913.

BEE-KEEPING IN VICTORIA.

(*Continued from page 761, Vol. X.*)

By F. R. Beuhne, Bee Expert.

XI.—INTRODUCING QUEENS.

The beginner in bee-keeping often has difficulty and sometimes absolute failure in introducing a new queen to a colony of bees. Many of the queens obtained annually from queen breeders are lost in introduction, even by bee-keepers of some experience. The mood or temper of bees and their behaviour towards man and towards their own species are governed by climatic influences, variations in the secretion of nectar, and the methods of manipulation of modern bee-keeping. Incidentally it may here be pointed out that viciousness is a characteristic of some strains, and even of individual colonies of bees, and that such bees will sting when handled even under the best condition; there is, however, no additional difficulty in their inherent wickedness so far as the acceptance of a queen is concerned.

When colonies are in normal condition, the printed instructions usually sent out with queen bees will insure safe introduction; under certain conditions, which will be referred to further on, the usual method must, however, be entirely departed from. To introduce a new queen to a colony it is, first of all, necessary to find and remove the queen which is to be replaced. It is during this operation that, in most instances, the foundation for future trouble is laid. When the queen to be removed is a black or brown one, it often takes considerable time to find her. Bees from other hives are attracted, and the bees of the colony operated on are roused to a state of attacking any stranger; and, when the new queen appears amongst them a day or two later she may be killed right away or balled and worried to death.

Trouble is sometimes created by returning to the hives newly-extracted combs at a time when, unperceived by the bee-keeper, the honey flow has ceased, and a commotion is caused which is communicated to all the colonies; bees may be seen at the joints between the hive bodies or wherever the odour of honey escapes; when a hive is opened they hover round or boldly dive in between the combs. Under these conditions bees sometimes ball their own queens, and are very unlikely to accept a strange queen when deprived of their own.

The hunting up of queens should be done towards evening, when bees have ceased to fly; care should be also taken that no honey is spilt from combs so as to attract robber bees or ants next day. Bees will most readily accept a new queen after being queenless for from 24 to 48 hours. If queenless longer, queen-cells will have been started and the bees will be less friendly disposed towards a new queen.

In such a case it is better to wait a few more days, when all worker brood will be capped, and, having no means of raising a queen of their own, the bees will usually readily accept a new queen—provided *all* queen cells are destroyed before she is introduced. With a populous colony it is difficult to find all the cells, some of which may be quite small and on the face of the comb. To make sure that none are left it is best to shake the bees off the brood combs, one at a time, and carefully examine the comb all over.

If a queen is to be introduced to a colony, assumed to be queenless because no eggs are present in the combs, a test-comb containing young larvæ from another colony should first be given to see whether the colony is really queenless, in which case queen-cells will be started by the bees within 48 hours. The comb may then be removed and returned to the hive it came from, and the queen introduced. If no cells are started on the test-comb, then a virgin queen is present in the hive and must be removed, as well as the test-comb, before the new queen can be given with safety.

When a queen is received by post, remove the cover of the cage and note her condition. If satisfactory remove the cork or covering slip from the end of the cage containing the candy and, if there is a queenless colony ready for introducing, place the cage wire downwards on top of the brood-frames. The bees, by gnawing out the candy, will release the queen in from two to five days. If, on examining the cage on receipt from the Post Office, the queen is found dead, notify the sender, and as proof return the cage with bees and dead queen—you will then receive another queen—all reputable queen-breeders guarantee safe arrival.

By the method of introduction described above, the worker bees which accompanied the queen are introduced along with her. If the candy in the cage is eaten out quickly and the queen released very soon, this escort of worker bees may cause trouble. Should the colony be in a perturbed condition, they are by their odour recognised as strangers, and the animosity aroused is often transferred to the queen, while the latter, having some of her own bees round her, will be shy of strangers and frightened when getting amongst them. In introduction much depends upon the behaviour of the queen when first released amongst the crowds of her new home. If the queen is removed from the escort of bees which accompanied her in the mailing

cage (Fig. 1), and kept alone for half-an-hour, she will beg food of the first bee she comes in contact with, and this is always given her, and thus acquaintance made. For introduction by this method, what is known as Miller's introducing cage (Fig. 2) is used. (This may be obtained from the dealers in bee-keepers' supplies.) It consists of a thin wire gauze cage into which the queen only is put, the square hole at the end being plugged up with candy from the mailing cage and the cage placed horizontally between two brood-combs.

The queen will be fed by the bees through the wire gauze till released by the candy being eaten out.

Under very adverse circumstances, such as a dearth of nectar in the flora, robber bees in the apiary, or after wet extracted combs have been returned to the hives when nectar is not coming in freely, the methods of introduction usually employed often fail. If a queen *must* be introduced, it is best, before attempting it, to remove all combs containing brood, except one which is left till evening to prevent the

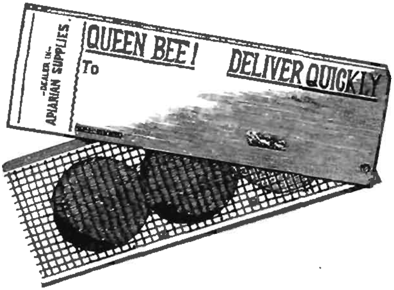


FIG. 1.—MAILING CAGE.

bees leaving and joining neighbouring hives. At dusk, shake the bees off this comb, give it to some other colony to take care of, and hang the caged queen between the broodless combs. When the brood is removed, the bees should be shaken off and the combs put on other colonies till after the new queen is safely laying, when they may be returned again without bees.

Success in introducing queens is assured largely by a minimum of interference and fussing. Most of the failures are due to two causes; either the colony has been kept open too long when hunting for the old queen, or it has been opened and examined too soon and at the wrong time after introducing the new queen. Over-anxiety of the bee-keeper for her safety often proves fatal to the queen. Under unfavorable conditions bees will sometimes ball their own queens when the hive is opened, therefore a hive which has just had a new queen given to it should not be interfered with for at least four or five days, unless an unusual commotion at the entrance indicates that

the queen is balled. If desirous of ascertaining whether the queen has been accepted, do so on the fourth or fifth day after the bees have ceased flying for the day.

If a queen is found balled, drop the ball of bees into a saucer full of water, when the bees will release the queen. If smoke is used to

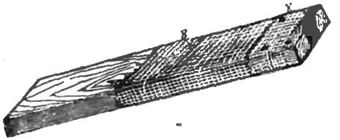


Fig. 2.—Miller's Introducing Cage.

scatter the ball the smoker should not be held too close, as hot smoke may cause the bees to sting the balled queen. The queen should be re-caged in the hive, allowing the bees to again liberate her by eating out the candy.

(To be continued.)

ON WATTLES AND WATTLE-BARK.

(Continued from page 692, Vol. X.)

Alfred J. Ewart, D.Sc., Ph.D., Professor of Botany and Plant Physiology in the Melbourne University.

II.—WATTLE-BARKS.

In the Bulletin of the Imperial Institute, much interesting information has been recently given in regard to wattle-barks, and as this information, which supplements that given by Baron von Mueller in the "Select Plants," and by Mr. Maiden in his article on "Wattles and Wattle-barks," may not be accessible to the ordinary reader, a summary of it is given.

Analyses are given of wattle-barks grown in different countries, for, as is well known, the cultivation of wattles for wattle-bark has not only been taken up with eagerness in South Africa, but also in other countries. For instance, Black, Green, and Golden Wattles, yielding respectively 40, 22, and 30 per cent. of tannin, are recommended for cultivation in Sicily; and at Palermo, *Acacia penninervis* (45 per cent. of tannin), *Acacia saligna* (30 per cent. of tannin), and

Acacia melanoxylon (20 per cent. of tannin), have already been grown with success. In addition, in German East Africa, *A. mollissima* and *A. decurrens* have been grown now for more than six years, and the bark was found to yield 44 per cent. and 38 per cent. of tannin respectively. The seed yielded by these wattles was found to be of first rate quality, and is being exclusively used for propagation in German East Africa.

The following data are given (*Bulletin of the Imperial Institute*, 1910, p. 246) of samples of wattle-barks from the Transvaal:—

Botanical Source.	Age of Tree.	Commercial Description.	Percentage of Tannin.	Character of Leather.	Estimated Value per Ton.
	Years.				£ s. d.
Acacia mollissima	14	"Sound, clean, bright bark"	42·1	Dull colour, good texture	9 0 0
.. ..	18	Well-grown, stout bark, with old, seasoned, and burnt scale	26·7	Rather dark, good texture	6 10 0
.. ..	8	Well grown, rather rough, hard mixed	41·5	Light colour, good texture	7 10 0
.. ..	26	Old, burnt bark of doubtful colour	21·8	Dark-reddish and harsh	5 0 0
.. ..	8	Small and bough bark, resembling Natal ordinary	38·6	Rather dull and somewhat harsh	7 5 0
.. ..	10	Partly burnt and wasteful	39·2	Light, but dull in colour, and rather harsh	6 15 0 to 7 0 0
.. ..	12	Partly burnt and wasteful	37·5	Good colour, rather soft	6 15 0 to 7 0 0
.. ..	9	Small and bough bark, resembling Natal ordinary	36·7	Good colour and texture	7 5 0
.. .. (?)	3	Somewhat resembles Cape Bark	27·9	Good colour, rather soft	5 10 0
.. *decurrens* ..	6	Short, thin, twig bark	24·4	Pale colour, soft, and rather spongy	5 10 0

WATTLE-BARKS FROM GERMAN EAST AFRICA.

—	Percentage of Tannin.	Commercial Description.	Value per Ton.
			£ s. d.
Acacia mollissima	40·1	Badly dried	8 0 0
.. *decurrens*	32·9	Dark-red ..	7 15 0

SAMPLES FROM THE EAST AFRICA PROTECTORATE. (*Acacia mollissima.*)

Age of Tree.	Commercial Description.	Percentage of Tannin.	Nature of Leather Produced.	Estimated Value per Ton.
Years.				£ s. d.
5	Well grown, mostly of good substance, clean but rather dark inside	38·4	Good colour and texture	8 0 0
4½	Well grown, mostly of good substance, clean but rather dark inside	43·8	Good colour and stiff texture	8 0 0
3½	Stout, better colour than Nos. 1 and 2	39·6	Good colour and stiff texture	8 5 0
3½	Equal to best Natal ..	40·3	Good colour and stiff texture	8 10 0 to 8 15 0
6½	Not quite so stout or well prepared as No. 4	35·8	Good colour and stiff texture	8 10 0
10	Smooth, pale reddish-brown fracture	39·7	Light-pinkish leather of good texture and appearance	8 15 0 to 9 0 0

WATTLE-BARKS FROM THE CAPE OF GOOD HOPE.

—	Percentage of Tannin.	Character of Leather.	Value per Ton.
			£ s. d.
Acacia pycnantha ..	40·00	Good	6 10 0 to 7 10 0
,, *decurrens* ..	35·36	Good	
,, ,, ..	44·15	Good	
,, *saligna* ..	26·38	Fawn coloured, but brittle ..	Some local value, but of no value for export
,, *horrida* ..	18·28	Brown, dull surface, brittle ..	
Mimosa Bark ..	18·00	Brown, dull surface, brittle ..	

It is evident from the above that wattle-bark can now be grown in various parts of the world, as well and as profitably as in its native home, Australia. In other words, the original monopoly has been lost; and if Australia is to regain predominance in regard to this commodity, it can only be done by the exercise of the same foresight, energy, and business qualities which have enabled other countries to become competitors in the world's market.

In three important respects, as Professor Paessler points out, wattle-barks are superior to most tanning materials. Firstly, their cost in regard to the amount of tannin available is low, and it is the more soluble tannin which is the most valuable. The less soluble portions are more difficult to extract, and produce a poorer leather. Secondly, any precipitation taking place in a tanning liquor on standing, not only hinders the tanning action on leather, but also represents the loss of a certain amount of tanning materials in the extract. In the following table Professor Paessler gives a comparison

between different tanning materials, and in the last column is included the amounts of insoluble matter deposited from tanning extracts of standard strength after standing for sixty days. As can be seen, the wattle-barks are especially satisfactory in this respect. Finally, in its power of producing a heavy leather, wattle-bark comes second only to quebracho wood.

—	Average Cost per Ton.	Average Per Cent. of Tannin Present.	Average Cost of Tannin per lb.	Insoluble Matter Deposited in 60 Days.
	£ s. d.		d.	
Oak Bark	5 6 8	9·0	6¼	7·5
Oak Bark Extract ..	12 11 2	25·0	5½	11·5
Valonia	12 11 2	27·0	5⅛	29·0
Quebracho	6 1 7	19·0	3¼	3·4
Divi-Divi	12 3 10	28·0	3⅛	29·0
Wattle Bark	10 3 2	33·0	3¼	0·0
Myrobalans	7 12 5	30·0	2⅜	24·0
Mangrove Bark	7 12 5	38·0	2	0·0
Gambier	..	..	..	*0·0*
Galls	..	..	..	16·0

Imports and Exports of Tanning Bark.

Some attention has recently been drawn to the fact that tanning bark derived from acacias native to Australia, but now cultivated in other countries, is being imported into Australia to make good the deficiency in the native product. In order to be able to give exact information in regard to this matter, Mr. G. H. Knibbs, the Commonwealth Statistician, has very kindly forwarded me information in regard to the exports and imports of tanning barks for 1911.

Imports—Bark (Tanning) 1911.

Country of Origin.	Cwt.	£
Fiji	315	174
Other South Sea Islands	154	44
Papua	93	24
South Africa	71,685	30,808
Italy	200	113
Total	**72,447**	**31,253**
Importing States.		
New South Wales	54,898	24,031
Victoria	10,325	4,349
Queensland	59	29
South Australia	6,075	2,361
Western Australia	1,090	483
Total	72,447	31,253

Exports—Bark (Tanning) 1911.

Country of Origin.	Cwt.	£
New South Wales	8,933	3,883
Victoria	33,370	14,599
South Australia	11,021	5,089
Western Australia	175,590	70,947
Tasmania	24,637	10,118
Northern Territory	5	10
Total	253,556	104,646

Mr. Knibbs adds that: "The records do not disclose any further information as to the particular kind of bark, but I include the particulars of the country of origin, which will probably furnish some indication. During 1911 the imported bark was almost entirely from South Africa, and would probably be wattle-bark."

Included under the imports of tanning materials are such products as myrobalans, valonia, &c., which are not really competitors of wattle-bark, but are used for special purposes for which wattle-bark is not suitable. Since these materials cannot be grown locally, at least not in Victoria, to compete with the native product, importation in such cases is a necessity. It is, however, evident from the countries of origin that these form a relatively small proportion of the total imports of tanning materials; and it certainly seems absurd that a country like Australia should be apparently in the process of becoming dependent on the outside world for supplies of one of its own native products. The main reason probably is that too much reliance has been placed on the natural growth, and insufficient attention to planting and re-establishment. The following table shows clearly that, for some years past, a tendency has existed towards a decrease in the exports and an increase in the imports of tanning material, and this in spite of the fact that good prices are obtainable locally, and there is a steady and increasing demand for tanning materials:—

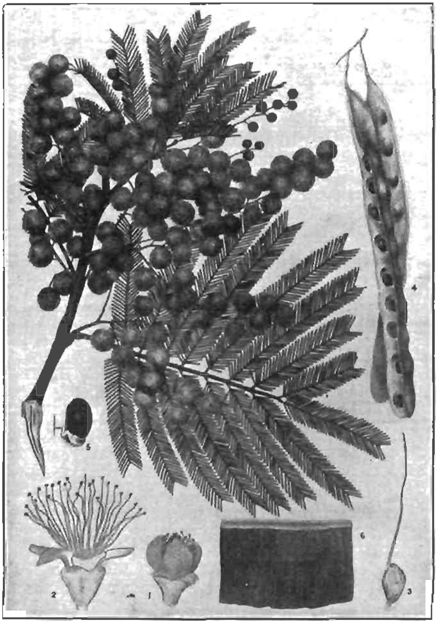
Imports and Exports of Tanning Bark during 1906–1911.

Particulars.	1906.	1907.	1908.	1909.	1910.	1911.
Quantities—	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Imports	63	344	38,711	28,020	12,648	72,447
Exports	*431,896*	*358,167*	*260,364*	*225,872*	*295,616*	*253,556*
Excess of Exports over Imports ..	431,833	357,823	221,653	197,852	282,968	181,109

Practical Hints and Suggestions.

It is evident from the foregoing that there is a deficiency in the local production of wattle-bark which should be made good by an increase of planting of suitable acacias. If, however, this is to be profitable, it must be done on practical and business lines; and there are certain pests, particularly the "Fire Blight," *Paropsis orphana,*

which have been responsible for the destruction of or serious damage to large plantations intended for the production of wattle-bark. This pest appears to be specially injurious to the Common Black Wattle, *Acacia decurrens*, and to do little or no damage to the Golden Wattle, *Acacia pycnantha*. It is possible that if in the large plantations mentioned the chessboard system of planting had been adopted, and the acacias planted in small squares surrounded by other trees, there



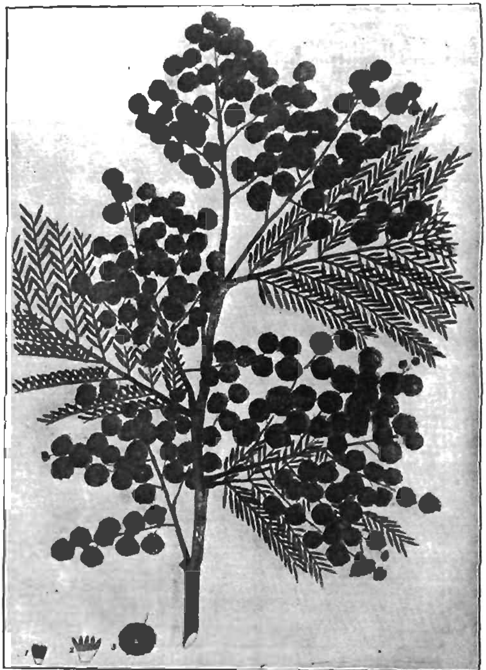
* ACACIA DECURRENS (EARLY BLACK WATTLE).

would have been greater scope for checking the spread of the pest. There are, however, risks of this kind in all natural industries, and the fact that acacias have thrived and survived so well in Victoria for ages past, and have survived their numerous foes, shows that it is merely necessary to repeat the proper conditions for their growth to attain success in wattle cultivation.

* Photo from "Flowering Plants of New South Wales."

The following facts and practical information were obtained from technical and reliable sources:—

"The best bark is grown towards the west of Victoria, and it becomes less valuable towards the east, *i.e.*, towards Gippsland. The least variation of value according to locality appears to be shown by the Golden Wattle wherever it is grown, so far as the available



ACACIA MOLLISSIMA (LATE BLACK WATTLE).

local data are concerned. Very good bark comes from the district within a 35-40 miles radius of Portland; and good bark, mainly from the green and black wattles, comes from the districts around the Grampians (Stawell, &c.).

The imports of wattle-bark from South Africa are increasing

the demand, or is even increasing. This, again, is largely due to the indiscriminate destruction of wattles, without any attention being paid to their replacement, either naturally or artificially. They cannot re-establish themselves when continually grazed or trampled down by stock. The occasional failure of plantations is either due to lack of attention and care, or sometimes to too much zeal in cultivation, thinning, or pruning, actually encouraging the attacks of pests.

For prime samples of wattle-bark delivered in Melbourne, from £7 10s. to £8 per ton can be obtained. This applies only to the bark from the best species (golden, black, and green wattles, *A. pycnantha, decurrens, mollissima*). Where sufficient naturally grown plants exist, the bark of the Silver Wattle (*Acacia dealbata*) is worth collecting, and is used for rough tanning. It is not, however, much used locally, is hardly worth exporting, and is certainly not worth planting in comparison with the better wattles. In all cases the best bark appears to come from trees growing naturally in mixed forests.

Trees are ready to strip when they have grown to good upstanding trees with a sufficient surface of the main trunk smooth and well grown. Usually trees six or seven years old are in this condition, and ready for stripping; but to some extent the age at which the tree is ready for stripping will depend upon the species of acacia and the district and conditions under which it is grown. Under favorable circumstances wattles grow with great rapidity. Thus a tree of *Acacia mollissima* grown in the Herbarium grounds attained a diameter at the base of 26 inches at a height of 1½ feet above ground, and a height of 25 feet in four years, and would have been quite ready for stripping in that time.

It is when acacias are approaching adult size that they seem to become especially prone to the attacks of "Woolly Blight," borers, "Fire Blight," &c., and they appear to be especially prone to the first named when growing in unnaturally exposed situations. In addition, beyond a certain age the bark appears to deteriorate both physically and chemically from an economic stand-point.

The best time to strip the bark is in spring and early summer, when the sap is rising. At that time, not only does the bark come off more easily, but it is in a better condition for tanning purposes. When stripped it should be dried in thin layers of strips laid on rough frames made of wood or branches, and raised about 1 foot above ground. The strips when fully dried and bound in bundles are ready for sale as the commercial article wattle tanning bark. They should on no account be bound in bundles or stacked until quite dry, since otherwise they become mildewed, dark coloured, and deteriorate considerably in value. Neglect of this simple precaution often causes much loss."

Mr. J. Blackburne, formerly Inspector, Forests Department, sends me some interesting information, from which I extract the following:—

"At Majorca, in 1882 and 1883, we put in a considerable area of *Acacia pycnantha*. The soil was a granite drift, very suitable for wattle culture. After ploughing and softening 1 lb. of seed per acre over night for the next day's sowing, each 1 lb. of seed was mixed with six small buckets of finely sifted soil, then sowed broadcast and brush-harrowed in. The first year after sowing they were

thinned by cutting out with heavy hoes to a distance of about 7 feet apart. In seven years the return of bark was about 5 tons per acre.

There are two well-marked varieties of *Acacia pycnantha.* One has a thin bark, reddish-brown in colour, the other a thick bark of a yellowish-brown tint. The *latter* is by far the best.

If the seed were drilled in 7 feet apart, two or three seeds in each hole, and the superfluous seedlings removed later, less seed would be required per acre.

ACACIA PYCNANTHA (GOLDEN WATTLE).

We also sowed at Majorca *A. decurrens* mixed with eucalypts, and they did splendidly, making clean straight stems up to 30 feet in height, easily stripped, and yielding bark of good quality with 35 to 40 per cent. of tannin. Wattles are grown naturally by this system.

Acacia pycnantha is rather tender, and is apt to be damaged in its young state by severe frost. If wattles alone were put in granite soil, deep, with a porous clay subsoil, I would prefer *A. decurrens*

to *A. pycnantha* (using about ¾lb. of seed per acre), although *A. mollissima* also does well in the Grampians in soil made by the wearing down of the sandstone ranges there. A good average rainfall is also a necessity for success. Plantations can be cheaply formed if there is plenty of *débris*, bracken fern, &c., on the ground, by sowing seed broadcast on the area chosen, and then letting a fire go through it. I would double the quantity of seed in such experiments, and cut out the surplus growth the first year after sowing."

For the following facts I am indebted to Mr. H. Mackay, Conservator of Forests:—

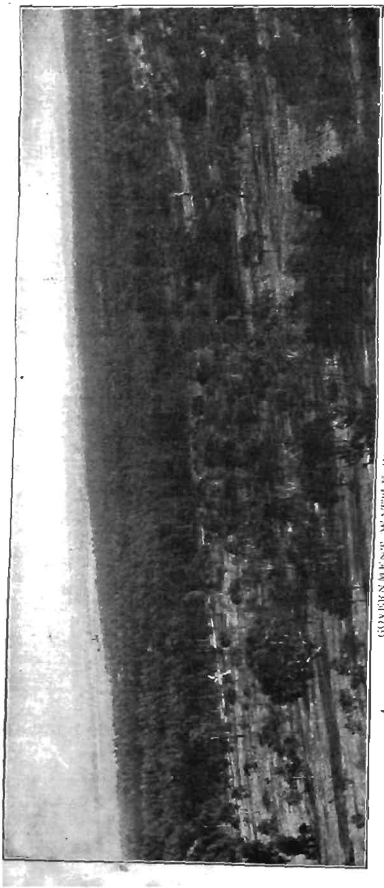
"The Forests Department has about 20,000 acres of natural wattle plantations, consisting chiefly of *Acacia mollissima*, "Late Black Wattle." These are mainly in the Victoria Valley, in the Grampians, also on the north side of Victoria Range, the same wattle covers areas of 4,000 acres or more.

The plantations made by the Department include in recent years about 5,000 acres, of which 2,500 are in the Kentbruck district, between Portland and Nelson, on the South Coast. These plantations consist almost wholly of *Acacia pycnantha*, which grows well, but suffers from cold in dry winters wherever the limestone is near to the surface. It has, however, the advantage of not being prone to the attacks of "Fire Blight." These plants are from five to six years old, and the first stripping will take place next year.

At the You Yangs, 14 miles from Geelong, is an old plantation established first in 1887 by the late Mr. Fergusson, officer in charge of the State Nursery at Macedon. Bluegum and wattle seeds were mixed and sown broadcast. This is a good method of providing a shelter belt, but if the other trees such as gums or pines are too close together, the wattles suffer. On the other hand, since the wattles are sensitive to winds and frosts, some protection is beneficial to them. In close, warm gullies, however, they are especially apt to suffer from "Fire Blight," the beetles which cause the mischief breeding especially well under moist warm conditions. For districts within 50 miles of the coast, the best wattle to plant is *A. pycnantha*, with broad, flat leaves or phyllodes, instead of the delicate foliage of the Black and Green wattles. The Golden Wattle will also grow further inland, but becomes too small in size.

The question of costs and profits depends to some extent upon freedom from disease and pests, from the ravages of fires, and upon the vicinity to markets such as Melbourne and Geelong, where large tanneries are established. In addition, the cost of hand stripping, which was formerly 30s. per ton, has now risen to £2 or £2 5s. per ton. The price of wattle-bark, which twenty-seven or thirty years ago varied from £9 to £11 per ton, now varies according to quality from £6 5s. to £7 10s. per ton. Exaggerated ideas are prevalent as to the profits to be derived from wattle plantations, and statements have been published that £10 per acre would be an average profit. Taking an average quality of poorer soils, such as granite slopes, limestone pebbles, uplands, or sandy loam, and allowing for the cost of fencing and netting to exclude sheep and rabbits for at least the first four years, the profit per acre where a plantation has been maintained successfully would be nearer £5 or £6 per acre as the results of strippings

extending from the sixth to the tenth year. Assuming a profit per sheep of 4s. to 6s. per annum by their natural increase and wool, and bearing in mind the fact that the return is quicker and the profits are obtained with less risk and greater certainty, grazing is a more profitable way of utilizing the land than wattle planting, and it will certainly not pay to convert good grazing land into wattle plantations.



GOVERNMENT WATTLE PLANTATION, LARA (YOU YANGS).

In the case of the plantation at the You Yangs, fair profits are made each year; but a private owner would need to add to his profit and loss account the interest on the capital represented by the land, and on the original cost of the plantation.

In comparing the cultivation of wattles in South Africa and in Australia, it should be remembered that the former has certain advantages. Firstly, the freight to Hamburg or London is less than from Australia. Secondly, a supply of cheap black labour is available. Thirdly, in some parts of South Africa, at least, the wattles

appear to be ready for stripping a year soner than in Victoria. There is no doubt, however, that there is a considerable amount of poor class land at present being put to no use, which might well be devoted to the cultivation of wattles. It is not likely that any one would attempt to grow wattles for profit on the carbonaceous sandstone of Gippsland, which afford rich pastures for dairying, or on fertile volcanic soils suitable for cultivation; but it may be as well to mention that wattles grown on such soils tend to be of a spindly nature, with a thin bark inferior for tanning purposes. As a rule, the best bark is obtained from granitic formations, while that from ironstone pebbles with a clay subsoil approaches and sometimes equals it. The bark from trees grown in sandy loam usually contains a little less tannic acid, but affords a good quality bark; and, in fact, yields the greater proportion of the supplies grown in Victoria.

The principal districts from which naturally grown bark is obtained are the Dartmoor district on the Lower Glenelg, the Avenel, Seymour, and Tallarook districts, the Briagolong and Glenmaggie districts in North Gippsland, and the Cunningham and Mitchell River districts in East Gippsland. The Gippsland bark is thinner, and not quite so good as that from the other localities."

The general trend of the facts mentioned above is to show that there is an opening for an increased growth of wattles for tanning bark in Victoria, but that there are certain risks attached to its profitable cultivation on a large scale, and that success is rewarded by reasonable but not extravagant profits. Apparently, the proper position is that it should enable land-owners to extract a profit from poor land they could not otherwise profitably utilize, and be more as a side line than as a mainstay of support. The cultivation of wattles does not appear to offer any openings to the man of small capital, to whom quick returns are essential.

Cream rises faster in warm milk, and also faster in cooling milk. The first is partly due to fat expanding more than water when it is warm, and the second to fat being a worse conductor of heat and cooling more slowly when the milk stands.

About 80 per cent. of the fat in milk is recovered by shallow setting, and 95 per cent. with a good machine.

GENERAL NOTES.

AGRICULTURAL CO-OPERATION IN GREAT BRITAIN.

Of late years the co-operative movement has developed in Great Britain in a notable manner, and a report recently issued by the Board of Trade states the position of affairs in 1909. Co-operative societies have been formed for various objects, such as insurance and the manufacture of dairy produce, but the most flourishing of the societies are those whose business may be described as distributive. These societies exist for the collective purchase of the manures, seeds, implements, &c., required by the members, and for the collective sale of their produce. In 1909 there were 176 such societies at work, with a membership of 17,449, as compared to 5 societies in 1895. The sales effected through the societies totalled £1,112,824, and the profit earned was £10,088. The latter is obtained as commission from members on transactions effected on their behalf, in most cases the amount charged being just sufficient to clear working expenses.

INOCULATION OF LUCERNE.

Crops all require nitrogen for their growth. An advantage possessed by lucerne and other leguminous crops is that they are not dependent on the soil for their nitrogen supply, but are able to utilize the free nitrogen of the atmosphere. It is a bacterium present in the soil which enables them to use the atmospheric nitrogen, and in doing this the bacterium forms little wart-like nodules on the roots. These nodules may be seen after digging a plant up. It sometimes happens, however, on land new to lucerne that the necessary bacterium is not present, and then no nodules are formed, and the lucerne becomes dependent on soil nitrogen like any ordinary farm crop. As lucerne requires an excessive amount of nitrogen (probably acquired character), the absence of nodule formation is peculiarly disastrous. In such cases inoculation is necessary to supply the needed bacterium. In the *Agricultural Gazette* of New South Wales, experiments are quoted from Hawkesbury showing the effect of different methods of inoculation. Tests were made of supplying pure diluted cultures of the germ to the seed and soil, and also of sprinkling some soil from an old lucerne paddock on land laid down to lucerne. The results were ascertained by counting the root nodules when the plants were about three months old. Where no inoculation was practised there were no nodules. The best results were obtained by sprinkling soil from an old paddock, 62 per cent. of the plants then showing nodules with a complete manure, and 96 per cent. where 1 ton of lime had been applied. The value of lime to lucerne can be insisted on. American experience also (*Abs. in Science*, 35 (1912), No. 893) gives the preference to soil from old well-inoculated fields rather than to the use of pure cultures which are more uncertain, presumably owing to deterioration in keeping. At Hawkesbury the soil was applied at the rate of 7 tons per acre; but although the large application may

act more quickly, small dressings of 1 or 2 cwt. will more generally be applied. Such applications cost little, and are very desirable where lucerne is languishing and shows no nodules. The inoculating soil except in dull showery weather, should be harrowed-in immediately after application, as strong light will destroy the bacterium.

SILAGE FOR HORSES.

Horses and colts may be fed good sound maize silage in limited quantities, especially when not at work. When at work, silage may be fed on Saturday nights and a meal or two on Sunday. The working horse requires a stronger feed than silage, for its digestive tract is not large enough to take sufficient quantities of silage to supply the needed nutriment for doing work. Silage fed to working horses in large quantities has, to a considerable extent, the same effect as grass, which all horsemen know is weakening, although a good feed for mares suckling colts.—*Hoard's Dairyman.*

DESTRUCTION OF CHARLOCK.

The seeds of charlock or wild mustard can lie dormant for many years in the soil, and then the plant suddenly appears when the land is brought under cultivation. In a root crop the weed can be kept down by hoeing or other mechanical means, but in a cereal crop this is practically impossible, with the result that the weeds produce a fresh supply of seed which is shed and returned to the soil. Some years ago a Frenchman discovered that charlock could be destroyed by spraying with solution of copper sulphate (blue-stone) without damage to the cereal crop growing along with it. Experiments were conducted in different countries as to the best strength of spray to use, the best quantity, and the time to apply it. Practical advice is given to farmers in *Leaflet 63*, issued by the Board of Agriculture, London. Good results will usually be got from 16 lbs. of copper sulphate, dissolved in 40 gallons of water, for 1 acre. Instead of copper sulphate, costing 4s. 6d., 60 lbs. of iron sulphate, costing 2s. 6d., may be used. The quantities indicated do no permanent harm to cereals, but beans or peas require a weaker application. The weed should not exceed 3 inches in height at the time of spraying. The copper sulphate should be obtained powdered to facilitate solution. The spraying machine should generate a fine spray under air pressure, and a horse machine should cover 30 to 40 acres per day. Rain immediately after spraying will interfere with success, and better results will be got in dull weather than in bright sun. Recent tests in California with iron sulphate, using 140 lbs. per acre, proved effective in killing mustard, but not wild radish. Still more recently in France, an 8 per cent. solution of sulphuric acid has been used with the best results on autumn-sown cereals. Owing to its corrosive action, however, the acid requires a special spraying machine, and on this account the copper sulphate will generally be preferred.

THE ARTIFICIAL MANURES ACTS.

UNIT VALUES FOR 1913.

By P. Rankin Scott, Chemist for Agriculture.

The amending Artificial Manures Act of 1910 requires that manufacturers or importers shall, on or before the 1st November in each year, register the brand of the several fertilizers, and at the same time supply to the Secretary for Agriculture, under declaration, the name and address of manufacturer or importer, the place of manufacture, the raw material from which the manure is manufactured or prepared, a statement of the percentages of nitrogen, phosphoric acid, and potash, together with the respective forms in which they occur, and the retail price per ton. From the information so obtained the unit values of the constituents which have a commercial value are calculated. These unit values so obtained constitute the basis of calculating the values of all manures for the period during which the registered brands continue in force, *i.e.*, until the publication in the *Government Gazette* of the list of registered brands for the following season.

A fixed limit of deficiency is allowed in all fertilizers. (See Schedule hereunder.)

When a manure on analysis is shown to contain less nitrogen, phosphoric acid, or potash than the proportions stated on the label or invoice certificate, to the extent set forth in the Schedule the vendor is liable to a fine of £10 for a first offence, and £50 for any subsequent offence.

SCHEDULE.

Description of Manure.	Percentage of Deficiency allowed in regard to Ingredients of Fertilizing Value.				
	Nitrogen.	Potash readily soluble.	Phosphoric Acid.		
			Water soluble.	*Citrate soluble.*	*Citrate Insoluble.*
All manures containing Nitrogen ..	0·50				
All manures containing Potash ..	..	1·00			
All manures containing Water Soluble Phosphoric Acid ..	..	..	1·00		
All manures containing Citrate Soluble Phosphoric Acid ..	..	..	..	1·00	
All manures containing Citrate Insoluble Phosphoric Acid ..	..	..	..	..	1·00

NOTE.—Provided that the total phosphoric acid deficiency shall not exceed 1·50 per cent.

Regarding the label and invoice certificate referred to above, sections 5 and 7 of the principal Artificial Manures Act of 1904 stipulate that the vendor shall attach to each bag a label or tag declaring the composition of the manure, and shall deliver to all purchasers of

manure, at the time of sale, an invoice certificate, conveying similar information to that required to be stated on the label.

From the unit values and the guarantee contained on the tags or invoice certificates, it can be readily ascertained (see method of calculation) whether the price asked for a fertilizer is a reasonable one.

In basing a valuation on mixed manures, by this method of calculation, *the price asked generally exceeds the commercial value of the fertilizing ingredients contained* in them, the increased cost of these mixed manures represents the cost of mixing, bagging, &c.

Artificial Manures Acts.

UNIT VALUES OF MANURES FOR THE YEAR 1913 AS *CALCULATED FROM THE DECLARED PRICES* OF FERTILIZERS REGISTERED AT THE OFFICE OF THE SECRETARY FOR AGRICULTURE.

	s.	*d.*
1 per cent. of Nitrogen as Nitrate	18	6
1 per cent. of Nitrogen as Ammonia	15	7
1 per cent. of Nitrogen as Organic in Blood	15	9
1 per cent. of Nitrogen as Organic in Fine Bone	15	0
1 per cent. of Nitrogen as Organic in Coarse Bone and Bone and Dried Flesh	13	0
1 per cent. of Phosphoric Acid as Water Soluble	4	9
1 per cent. of Phosphoric Acid as Citrate Soluble	4	6
1 per cent. of Phosphoric Acid as Fine Bone	4	6
1 per cent. of Phosphoric Acid as Coarse Bone	3	6
1 per cent. of Phosphoric Acid as Insoluble, in Bone Superphosphates, Bone Fertilizers, and Thomas Phosphates	3	0
1 per cent. of Phosphoric Acid as Insoluble in all other Manures	2	0
1 per cent. of Potash as Nitrate	7	0
1 per cent. of Potash as Sulphate	5	8
1 per cent. of Potash as Chloride	4	10

NOTE.—Potash in Kainit is valued as Sulphate.

Method of Calculating the Value of a Manure.

The value per ton of a manure sold in Victoria is obtained by multiplying the percentages stated of the fertilizing substances by the corresponding unit values fixed therefor, and adding the separate values together.

As per example:—

		£	s.	d.
1. Nitrate of Soda—				
Invoice certificate on tag ..	15·5 per cent. of Nitrogen.			
Calculation—				
15·5 x 18s. 6d. = ..	..	14	8	4
Calculated value per ton ..	..	14	8	4
2. Superphosphate—				
Invoice certificate on tag—				
Water Soluble Phosphoric Acid ..	17·00 per cent.			
Citrate Soluble Phosphoric Acid ..	1·00 ..			
Insoluble Phosphoric Acid ..	2·00 ..			
Total Phosphoric Acid ..	20·00 ..			
Calculation—		£	s.	d.
Phosphoric Acid (Water Soluble), 17 x 4s. 9d. ..	..	4	1	9
Phosphoric Acid (Citrate Soluble), 1 x 4s. 6d. ..	..	0	4	6
Phosphoric Acid (Citrate Insoluble), 2 x 2s. ..	..	0	2	0
		4	8	3
3. Bonedust—				
Invoice certificate on tag—				
Nitrogen ..	3·00 per cent.			
Phosphoric Acid ..	20·00 ,,			
Mechanical condition—				
Fine bone ..	40·00 ,,			
Coarse bone ..	60·00 ,,			
Calculation—		£	s.	d.
Nitrogen—Fine bone $\frac{3 \cdot 0 \times 40}{100}$ = 1·20 x 15s. ..	..	0	18	0
Nitrogen—Coarse bone, $\frac{3 \cdot 0 \times 60}{100}$ = 1·80 x 13s. ..	..	1	3	5
Phosphoric Acid—Fine bone, $\frac{20 \times 40}{100}$ = 8·00 x 4s. 6d. ..	..	1	16	0
Phosphoric Acid—Coarse bone, $\frac{20 \times 60}{100}$ = 12·00 x 3s. 6d.		2	2	0
		5	19	5
4. Mixed Manure—				
Invoice certificate on tag—				
Nitrogen as Ammonia ..	2·00 per cent.			
Phosphoric Acid (Water Soluble) ..	10·00 ,,			
Phosphoric Acid (Citrate Soluble) ..	1·00 ,,			
Phosphoric Acid (Citrate Insoluble) ..	2·00 ,,			
Phosphoric Acid Total ..	13·00 ,,			
Potash as Sulphate ..	7·50 ,,			
Calculation—		£	s.	d.
Nitrogen as Ammonia, 2·0 x 15s. 7d. ..	..	1	11	2
Phosphoric Acid (Water Soluble), 10 x 4s. 9d. ..	..	2	7	6
Phosphoric Acid (Citrate Soluble), 1 x 4s. 6d. ..	..	0	4	6
Phosphoric Acid (Citrate Insoluble), 2 x 2s. ..	..	0	4	0
Potash as Sulphate, 7·50 x 5s. 8d. ..	..	2	3	6
		6	10	8

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS.

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Potash.	Price asked for the Manure per ton.	Where Obtainable.
Mainly Nitrogenous.		%	%	%	£ s. d.	
Sulphate of Ammonia	*Federal A.S.*	20·00	..	..	16 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,, ,,	Sickle	20·00	..	..	16 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,,	Hasell's	20·00	..	..	15 17 6	A. H. Hasell, Melbourne
,, ,,	M.G. Co.	20·00	..	..	14 0 0	Metropolitan Gas Co., Melbourne
,, ,,	M.L.	20·00	..	..	16 0 0	Mt. Lyell M. and R. Co Ltd., Melbourne
,, ,,	Wischer's	20·00	..	..	16 0 0	Wischer and Co. Prop. Ltd., Melbourne
Nitrate of Soda	Federal S.N.	15·50	..	..	14 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,,	Sickle	15·50	..	..	14 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,,	Hasell's	15·50	..	..	14 5 0	A. H. Hasell, Melbourne
,,	M.L.	15·50	..	..	14 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
,,	Wischer's	15·50	..	..	14 10 0	Wischer and Co. Prop. Ltd., Melbourne
Blood	Imperial	11·50	1·00	0·18	9 15 0	W. Angliss and Co. Prop. Ltd., Melbourne
,,	Federal Blood	7·50	1·00	..	6 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,,	Champion	11·00	2·00	..	7 15 0	John Cooke and Co., Melbourne
,,	Sickle	7·50	1·00	..	6 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,,	M.C.C.	7·50	1·00	0·41	4 8 9	Melbourne City Council, Melbourne
Blood, "A"	M.L.	11·00	..	..	10 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Blood, "B"	,,	7·50	1·00	..	6 10 0	,, ,, ,, ,,
Blood and Bone	,,	6·50	6·20	..	6 15 0	,, ,, ,, ,,
Blood	Wischer's	7·50	1·00	..	6 10 0	Wischer and Co. Prop. Ltd., Melbourn
Mainly Potassic.						
Kainit	Sickle	..	..	12·40	5 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,,	M.L.	..	..	12·40	5 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
,,	Wischer's	..	..	12·40	5 0 0	*Wischer and Co. Prop.* Ltd., Melbourne
Nitrate of Potash	Sickle	13·00	..	46·00	28 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,,	M.L.	13·00	..	46·00	28 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Potash Chloride (Muriate)	Federal P.M.	..	..	60·00	14 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
,, ,,	Sickle	..	..	60.00	14 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,, ,,	Hasell's	..	..	60.00	14 5 0	A. H. Hasell, Melbourne
,, ,,	M.L.	..	..	60·00	14 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
,, ,,	Wischer's	..	..	60 00	14 10 0	Wischer and Co. Prop. Ltd., Melbourne
Potash Sulphate	Federal P.S.	..	..	52·00	14 12 6	Australian Explosives and Chemical Co. Ltd., Melbourne
,,	Sickle	..	..	52·00	14 12 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
,,	Hasell's	..	..	52·00	14 10 0	A. H. Hasell, Melbourne
,,	M.L.	..	..	52·00	14 12 6	*Mt. Lyell M. and R. Co.* Ltd., Melbourne
,,	Wischer's	..	..	52·00	14 12 6	Wischer and Co. Prop. Ltd., Melbourne

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Citrate Soluble.	In-soluble.	Total.	Potash.	Price asked for the Manure per Ton.	Where Obtainable.
		%	%	%	%	%	%	£ s. d.	
Mainly Phosphoric, Phosphoric Acid easily Soluble.									
Concentrated Superphosphate	Federal Con. S.	..	40·00	4·00	..	44·00	..	12 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
" " "	Sickle	..	40·00	4·00	..	44·00	..	12 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " "	M.L.	..	40·00	4·00	..	44·00	..	12 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " "	Wischer's ..	..	40·00	4·00	..	44·00	..	12 10 0	Wischer and Co. Prop. Ltd., Melbourne
Superphosphate ..	Federal O.S. ..	..	17·00	1·00	2·00	20·00	..	4 7 6	Australian Explosives and Chemical Co. Ltd., Melbourne
" ..	Cockbill's ..	..	17·00	1·00	2·00	20·00	..	4 10 0	J. Cockbill, Melbourne
" ..	Sickle Florida ..	..	17·00	1·00	2·00	20·00	..	4 7 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" ..	Hasell's ..	..	17·50	0·50	2·00	20·00	..	4 7 6	A. H. Hasell, Melbourne
Superphosphate, No. 1 ..	M.L.	..	17·00	1·00	2·00	20·00	..	4 7 6	Mt. Lyell M. and R. Co. Ltd., Melbourne
Superphosphate ..	Rohs	..	16·85	1·70	0·45	19·00	..	4 12 6	P. Rohs, Bendigo
Superphosphate, No. 1 ..	Wischer's ..	..	17·00	1·00	2·00	20·00	..	4 7 6	Wischer and Co. Prop. Ltd.' Melbourne
Containing Nitrogen also.									
Nitro Superphosphate ..	Sickle	1·25	15·30	0·90	2·55	18·75	..	5 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " ..	Hasell's ..	1·50	13·00	1·00	3·00	17·00	..	5 8 6	A. H. Hasell, Melbourne
" " ..	M.L.	1·60	13·00	1·00	2·00	16·00	..	5 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " ..	Wischer's ..	1·50	13·18	1·52	2·30	17·00	..	5 10 0	Wischer and Co. Prop. Ltd. Melbourne
" " ..	Federal Nitro ..	1·10	13·00	1·00	5·00	19·00	..	5 10 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Blood, Bone, and Superphosphate	Federal B.B.S. ..	2·62	8·50	0·50	5·00	14·00	..	6 0 0	" " " "
Blood, Bone, and Superphosphate, "B"	Sickle	2·62	8·50	0·50	5·00	14·00	..	6 0 0	Cuming, Smith, and Co. Prop. Ltd. Melbourne
Blood, Bone, and Superphosphate	M.L.	2·62	8·50	0·50	5·00	14·00	..	6 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " "	Wischer's ..	2·63	8·50	0·50	5·00	14·00	..	6 0 0	Wischer and Co. Prop. Ltd., Melbourne

Dissolved Bone and Superphosphate	Sickle	1·00	10·01	3·88	5·48	19·37	..	5 10 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " "	M.L.	1·00	10·00	3·75	5·25	19·00	..	5 10 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " "	Wischer's ..	1·00	10·01	3·88	4·78	18·67	..	5 10 0	Wischer and Co. Prop. Ltd., Melbourne
Bone and Superphosphate, 1 and 3	Federal B.S., No. 3	0·75	12·75	0·75	5·50	19·00	.	5 5 0	*Australian* Explosives and Chemical Co. Ltd., Melbourne
Bone and Superphosphate, 1 and 1	Federal B.S., No. 1	1·50	8·50	0·50	9·00	18·00	.	5 12 6	" " " "
Bone and Superphosphate, 3 and 1	Federal B.S. (D) ..	3·25	4·25	0·25	12·50	17·00	..	6 0 0	" " " "
Bone and Superphosphate	S. and F. Bugg ..	1·45	8·05	7·20	5·05	20·30	..	5 15 0	F. and S. Bugg, Kyneton
" "	Cockbill's .	1·75	12·00	2·00	4·50	18·50	..	5 5 0	*J. Cockbill, Melbourne*
Bone and Superphosphate, 1 and 3	" ..	1·50	12·75	1·50	4·75	19·00	..	5 5 0	" "
Bone and Superphosphate, "A"	Sickle	1·50	8·50	0·50	9·00	18·00	.	5 12 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Bone and Superphosphate, "O"	"	0·75	12·75	0·75	5·50	19·00	..	5 5 0	" " " "
Bone and Superphosphate, "D"	"	2·25	4·25	0·25	12·50	17·00	..	6 0 0	" " " "
Bone and Superphosphate, 1 and 3	Hasell's .	0·80	12·75	1·25	5·50	19·50	.	5 4 0	A. H. Hasell, Melbourne
Bone and Superphosphate, 1 and 1	" ..	1·50	9·00	1·00	9·50	19·50	..	5 10 0	" " "
Bone and Superphosphate, No. 1	M.L.	1·50	8·50	0·50	9·00	18·00	.	5 12 6	Mt. Lyell M. and R. Co. Ltd., Melbourne
Bone and Superphosphate, No. 2	"	0·75	12·75	0·75	5·50	19·00	..	5 5 0	" " " "
Bone and Superphosphate, No. 3	"	2·25	4·25	0·25	12·50	17·00	..	6 0 0	" " " "
Animal Fertilizer and Superphosphate	A.N.A. Surprise .	1·50	7·59	2·95	5·51	16·05	.	5 10 0	G. W. Pennell, Deer Park
Bone and Superphosphate	Rohs	1·50	8·00	4·00	5·50	17·50	..	5 5 0	P. Rohs, Bendigo
Bone and Superphosphate, No. 1	Wischer's ..	1·50	8·50	0·50	9·00	18·00	..	5 12 6	Wischer and Co. Prop. Ltd., Melbourne
Bone and Superphosphate, No. 2	" ..	0·75	12·75	0·75	5·50	19·00	..	5 5 0	" " " "
Bone and Superphosphate, No. 3	" ..	2·25	4·25	0·25	12·50	17·00	.	6 0 0	" " " "
Phosphoric Acid moderately Soluble.									
Thomas Phosphate ..	Federal ..	..	..	14·00	3·00	17·00	..	4 7 6	Australian Explosives and Chemical Co. Ltd., Melbourne
" " ..	Sickle .. .	..	..	14·00	3·00	17·00	..	4 7 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " ..	Hasell's ..	..	..	14·00	3·50	17·50	..	4 2 6	*A. H. Hasell, Melbourne*
" " ..	M.L.	..	..	14·00	3·00	17·00	..	4 7 6	Mt. Lyell M. and R. Co. Ltd., Melbourne
" " ..	Wischer's ..	..	..	14·00	3·00	17·00	..	4 7 6	Wischer and Co. Prop. Ltd., Melbourne

List of Fertilizers Registered at the Office of Secretary for Agriculture under the Artificial Manures Acts—*continued*.

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total.	Potash.	Price asked for the Manure per ton.	Where Obtainable.
Phosphoric Acid difficultly Soluble.		%	%	%	%	%	%	£ s. d.	
Bone Fertilizer	Federal B.F. Special	5·00	..	3·00	12·00	15·00	..	7 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
" "	Federal B.F. ..	3·00	..	3·00	13·00	16·00	..	6 2 6	" " " "
" "	S. and F. Bugg ..	3·58	..	5·67	15·78	21·45	..	6 0 0	S. and F. Bugg, Kyneton
" "	Cockbill's ..	3·50	..	3·50	14·75	18·25	..	5 10 0	J. Cockbill, Melbourne
Bone Manure	" ..	6·00	..	5·00	10·00	15·00	..	7 0 0	" "
Animal Fertilizer ..	Champion ..	6·00	..	5·40	3·90	9·30	..	5 15 0	J. Cooke and Co., Melbourne
Bone Fertilizer	Sickle	3·00	..	3·00	13·00	16·00	..	6 2 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Bone Fertilizer, Special ..	"	5·00	..	3·00	12·00	15·00	..	7 0 0	" " " "
Bone Fertilizer	Elsworth ..	3·00	..	6·00	11·00	17·00	..	5 12 6	Exrs. J. R. Elsworth, Ballarat East
" "	Horseshoe ..	3·50	..	4·70	10·70	15·40	..	5 10 0	P. Fitzgerald, Bentleigh
Bone Fertilizer, Special ..	Magic	5·00	..	3·00	10·00	13·00	..	6 0 0	G. Gardiner and Co. Prop. Ltd., Geelong
Bone Fertilizer	Magic No. 1 ..	2·00	..	6·58	10·42	17·00	..	5 2 6	" " " "
" "	Magic No. 2 ..	1·50	..	3·10	12·90	16·00	..	4 17 6	" " " "
Bone Fertilizer, "A" ..	Hasell's ..	4·25	..	5·00	14·00	19·00	..	6 18 6	A. H. Hasell, Melbourne
Bone Fertilizer, "B" ..	" ..	3·48	..	3·77	15·43	19·20	..	6 12 6	" "
Bone Fertilizer "C" ..	" ..	2·52	..	2·73	15·51	18·24	..	5 12 6	" "
Bone Fertilizer	Echuca	5·12	..	3·75	11·50	15·25	..	5 10 0	Milo Bacon Co., Echuca
Bone Fertilizer, "A" ..	M.L.	5·00	..	3·00	12·00	15·00	..	7 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Bone Fertilizer, "B" ..	"	3·00	..	3·00	13·00	16·00	..	6 2 6	" " " "
Bone Fertilizer	Ark	3·69	..	6·68	10·27	16·95	..	6 0 0	A. Murphy, Ararat
Animal Fertilizer ..	A.N.A. Surprise ..	3·00	..	6·00	9·00	15·00	..	5 10 0	G. W. Pennell, Deer Park
" " ..	Wifco	7·50	..	5·50	4·00	9·50	..	6 0 0	Wimmera Inland Freezing Co. Ltd., Murtoa
Bone Fertilizer, Special ..	Wischer's ..	5·00	..	3·00	12·00	15·00	..	7 0 0	Wischer and Co. Prop. Ltd., Melbourne
Bone Fertilizer	" ..	3·00	..	3·00	13·00	16·00	..	6 2 6	" " " "
Blood and Bone Fertilizer	Federal B. & B. ..	5·25	..	1·50	7·00	8·50	..	6 15 0	Australian Explosives and Chemical Co. Ltd., Melbourne
" " "	Sickle	5·25	..	1·50	7·00	8·50	..	6 15 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " "	Wischer's ..	6·00	..	..	6·70	6·70	..	6 16 0	Wischer and Co. Prop. Ltd., Melbourne

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Ground Phosphate ..	Federal G.P. ..	..	..	..	36·65	36·65	..	5 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Pacific Island Guano ..	A.G.C. Flag ..	0·35	..	4·80	10·70	15·50	..	3 15 0	H. B. Black and Co., Melbourne
Maldon Island Guano ..	Sickle	..	..	..	22·90	22·90	..	4 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Ground Phosphate ..	"	..	..	..	36·65	36·65	..	5 0 0	" " " "
Guano	Hasell's ..	..	..	..	27·50	27·50	..	4 0 0	A. H. Hasell, Melbourne
"	M.L.	..	..	..	23·00	23·00	..	4 0 0	Mt. Lyell M. and R. Co Ltd., Melbourne
Ground Phosphate ..	"	..	..	..	36·65	36·65	..	5 0 0	" " " "
Guano	Wischer's ..	..	..	..	23·00	23·00	..	4 0 0	Wischer and Co. " Prop. " Ltd., Melbourne
Ground Phosphate ..	" ..	..	..	..	36·50	36·50	..	5 0 0	" " " "
Containing Nitrogen, Phosphoric Acid, and Potash.									
Sugar Beet Manure ..	Federal Beet ..	4·50	11·00	0·75	1·25	13·00	5·50	8 12 6	Australian Explosives and Chemical Co. Ltd., Melbourne
Top Dressing, Grass ..	Federal T.D. ..	1·60	11·00	0·64	1·30	12·94	1·50	5 5 0	" " " "
Grass Laying Manure ..	Federal G.L. ..	0·50	11·00	0·64	6·30	17·94	2·00	5 5 0	" " " "
Horticultural Manure ..	Federal H.M. ..	2·50	11·62	0·68	1·38	13·68	10·00	9 0 0	" " " "
Maize Manure ..	Federal M.Z. ..	2·36	10·20	0·60	6·20	17·00	2·00	6 7 6	" " " "
Onion Manure ..	Federal M.O. ..	2·00	11·00	0·64	1·30	12·94	5·00	6 7 6	" " " "
Orchard Manure ..	Federal F.M. ..	1·80	13·22	0·78	1·55	15·55	8·00	7 7 6	" " " "
Pea, Bean, and Clover Manure	Federal P.B. ..	0·50	10·00	0·60	4·20	14·80	3·00	5 5 0	" " " "
Potato Manure ..	Federal Potato ..	1·00	14·00	0·80	1·64	16·44	5·00	6 7 6	" " " "
Rape Manure	Federal Rape ..	0·98	10·50	0·62	4·18	15·30	2·00	5 10 0	" " " "
Vine Manure	Federal V.S.P. ..	7·00	7·15	0·42	0·84	8·41	12·00	12 10 0	" " " "
Mildura A. and P., No. 1	Sickle	3·46	9·41	0·55	1·10	11·06	11·60	9 7 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Mildura Citrus, No. 1 ..	" ..	1·39	3·79	0·22	7·87	11·88	16·25	8 15 0	" " " "
Grass Manure	"	0·30	11·05	0·65	8·85	20·55	3·00	5 5 0	" " " "
Horticultural Manure ..	"	4·00	11·22	0·66	1·32	13·20	8·40	9 0 0	" " " "
Maize Manure	"	2·20	14·62	0·86	1·72	17·20	1·80	6 7 6	" " " "
Onion Manure	"	2·00	13·60	0·80	1·60	16·00	3·60	6 7 6	" " " "
Orchard Manure ..	"	2·40	12·92	0·76	1·52	15·20	7·20	7 7 6	" " " "
Potato Manure, "A" ..	"	1·30	8·00	3·10	5·88	16·98	5·20	7 0 0	" " " "
Potato Manure, "B" ..	"	1·20	14·62	0·86	1·72	17·20	4·16	6 7 6	" " " "
Rose Manure	"	3·94	6·18	0·36	0·72	7·26	13·94	12 0 0	" " " "
Vine Manure	"	2·40	12·92	0·76	1·52	15·20	7·20	7 7 6	" " " "
Vine Manure, "B" ..	"	1·25	10·62	0·63	5·00	16·25	7·50	6 15 0	" " " "
Mildura Vine, No. 1 ..	"	5·53	7·14	0·42	0·84	8·40	11·60	10 15 0	" " " "
Mildura Vine, No. 3 ..	"	7·14	7·14	0·42	0·84	8·40	11·60	11 2 6	" " " "
Dissolved Peruvian Guano	Ohlendorff ..	5·73	11·95	..	0·81	12·76	1·47	13 5 0	Gibbs, Bright, and Co., Melbourne
Sugar Beet Manure ..	Hasell's ..	4·00	11·00	0·75	1·25	13·00	8·20	8 17 6	A. H. Hasell, Melbourne
Fodder Crop Manure ..	" ..	3·00	11·50	1·25	1·50	14·25	1·00	6 6 6	" "
Lawn Manure	" ..	0·40	11·25	1·00	8·50	20·75	2·50	5 5 0	" "
Grass Manure	" ..	0·40	11·25	1·00	8·50	20·75	2·50	5 5 0	" "

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.				Potash.	Price asked for the Manure per ton.	Where Obtainable.
			Water Soluble.	Citrate Soluble.	In-soluble.	Total.			
Containing Nitrogen, Phosphoric Acid, and Potash—continued.		%	%	%	%	%	%	£ s. d.	
Horticultural Manure ..	Hasell's ..	3·80	11·00	0·50	2·00	13·50	8·00	8 15 0	A. H. Hasell, Melbourne
Maize Manure	" ..	3·00	11·50	1·25	1·50	14·25	1·00	6 6 6	" "
Onion Manure	" ..	3·00	9·50	1·00	1·50	12·00	3·06	6 6 6	" "
Orchard Manure ..	" ..	2·00	14·00	0·75	0·25	15·00	7·14	7 7 6	" "
Potato Manure	" ..	1·00	12·75	0·75	2·00	15·50	6·00	6 5 0	" "
Root Crop Manure ..	" ..	3·20	7·00	1·00	2·50	10·50	4·50	6 15 0	" "
Tomato Manure ..	" ..	3·80	11·00	0·50	2·00	13·50	8·00	8 15 0	" "
Vine Manure	" ..	2·00	14·00	0·75	0·25	15·00	7·14	7 7 6	" "
Apricot and Peach, No. 1 Mildura	M.L.	4·46	9·41	0·65	1·10	11·06	11·57	9 12 6	Mt. Lyell M. and R. Co. Ltd., Melbourne
Citrus, No. 1 Mildura ..	"	1·39	3·61	0·21	7·82	11·64	16·88	8 17 6	" " " "
Fodder Crop Manure ..	"	3·00	11·00	1·25	1·75	14·00	1·00	6 7 6	" " " "
Grass Manure ..	"	0·30	11·05	0·65	9·05	20·75	2·70	5 5 0	" " " "
Horticultural Manure ..	"	4·00	11·00	0·75	1·45	13·20	8·25	9 0 0	" " " "
Maize Manure	"	3·00	11·00	1·25	1·75	14·00	1·00	6 7 6	" " " "
Onion Manure	"	3·00	9·50	1·00	1·50	12·00	3·00	6 7 6	" " " "
Orchard Manure ..	"	2·35	13·00	0·75	1·50	15·25	7·20	7 7 6	" " " "
Potato Manure	"	1·20	14·50	1·00	1·70	17·20	4·15	6 7 6	" " " "
Potato Manure with Bone	"	1·05	8·50	0·50	7·30	16·30	8·80	7 0 0	" " " "
Rape Manure	"	1·20	13·00	1·00	2·00	16·00	1·00	5 10 0	" " " "
Root Crop Manure ..	"	3·25	7·25	1·00	2·00	10·25	4·75	6 17 6	" " " "
Rose Manure	"	4·00	6·50	0·50	0·50	7·50	14·00	12 0 0	" " " "
Tomato Manure ..	"	4·00	11·00	0·75	1·45	13·20	8·25	9 0 0	" " " "
Vine Manure ..	"	2·35	13·00	0·75	1·50	15·25	7·20	7 7 6	" " " "
Vine, No. 1 Mildura ..	"	5·53	6·98	0·41	0·82	8·21	12·07	10 15 0	" " " "
Vine, No. 3 Mildura ..	"	7·14	6·98	0·41	0·82	8·21	12·07	11 5 0	" " " "
Vine, No. 5 Mildura ..	"	1·00	5·67	0·34	6·00	12·01	17·33	8 15 0	" " " "
Vine, No. 6 Mildura ..	"	1·12	6·37	0·38	6·75	13·50	13·00	7 17 6	" " " "
Market Gardener's Manure	Wischer's ..	3·38	9·35	0·55	1·10	11·00	6·50	7 7 6	Wischer and Co. Prop. Ltd. Melbourne
Grass Manure	" ..	0·75	9·80	0·75	5·15	15·70	2·60	5 5 0	" " " "
Key Fertilizer for Grass ..	" ..	0·50	15·30	0·90	1·80	18·00	2·60	5 15 0	" " " "
Hop Manure	" ..	2·00	14·00	1·00	1·00	16·00	5·00	7 2 6	" " " "
Horticultural Manure ..	" ..	3·00	11·25	0·70	1·30	13·25	9·70	9 0 0	" " " "
Maize Manure	" ..	1·75	14·65	0·85	1·75	17·25	2·60	6 7 6	" " " "
Onion Manure	" ..	2·50	9·15	0·95	1·58	11·68	4·50	6 7 6	" " " "
Nurseryman's Plant Food	" ..	5·00	8·50	0·50	1·00	10·00	13·00	12 0 0	" " " "

Orchard Manure ..	Wischer's ..	3·38	9·35	0·55	1·10	11·00	6·50	7 7 6	Wischer and Co. Prop. Ltd., Melbourne
Potato Manure	" ..	0·94	12·97	0·76	1·52	15·25	5·85	6 7 6	" " " "
Potato Manure with Bone	" ..	1·05	8·50	0·50	6·60	15·60	7·78	7 0 0	" " " "
Rape Manure	" ..	1·05	8·50	0·50	6·60	15·60	7·78	7 0 0	" " " "
Rose Manure	" ..	7·75	4·45	0·25	0·55	5·25	18·15	12 0 0	" " " "
Vine Manure	" ..	3·00	8·50	0·95	1·45	10·90	7·65	7 7 6	" " " "
Containing Nitrogen and Phosphoric Acid.									
Mildura A. and P., No. 2	Sickle	4·45	12·11	0·71	1·42	14·24	..	7 12 6	Cuming, Smith, and Co. Prop. Ltd., Melbourne
Mildura Citrus, No. 2 ..	"	2·02	5·52	0·32	11·45	17·29	..	5 17 6	" " " "
Top Dressing, Grass ..	"	0·70	16·40	0·97	1·93	19·30	..	5 5 0	" " " "
Rape Manure	"	1·25	15·30	0·90	2·55	18·75	..	5 10 0	" " " "
Mildura Vine, No. 2 ..	"	7·13	9·18	0·54	1·08	10·80	..	9 7 6	" " " "
Mildura Vine, No. 4 ..	"	9·20	9·18	0·54	1·08	10·80	..	10 0 0	" " " "
Rape Manure	Hasell's ..	1·20	14·25	1·00	2·25	17·50	..	5 7 6	A. H. Hasell, Melbourne
Apricot and Peach, Mildura No. 2	M.L.	5·75	12·11	0·71	1·42	14·24	..	8 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Citrus, No. 2 Mildura ..	"	2·02	5·54	0·33	11·43	17·30	..	5 17 6	" " " "
Vine, No. 2 Mildura ..	"	7·13	9·18	0·54	1·08	10·80	..	9 7 6	" " " "
Vine, No. 4 Mildura ..	"	9·20	9·18	0·54	1·08	10·80	..	10 0 0	" " " "
Containing Phosphoric Acid and Potash.									
Special Grain Manure ..	Federal S.O. ..	..	16·50	1·00	2·00	19·50	0·75	5 0 0	Australian Explosives and Chemical Co. Ltd., Melbourne
Leguminous Manure ..	Sickle	..	15·30	1·00	1·90	18·20	2·00	5 5 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
" " ..	Hasell's ..	..	12·00	1·00	3·00	16·00	4·50	5 5 0	A. H. Hasell, Melbourne
Lawn Manure	M.L.	..	7·00	11·00	1·00	19·00	2·00	5 6 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
Grass Manure	"	..	7·00	11·00	1·00	19·00	2·00	5 5 0	" " " "
Leguminous Manure ..	"	..	15·30	1·00	1·90	18·20	2·60	5 5 0	" " " "
Pea Manure	Wischer's ..	..	14·45	0·85	1·70	17·00	7·78	6 10 0	Wischer and Co. Prop. Ltd., Melbourne
Leguminous Manure ..	" ..	..	15·30	1·00	1·90	18·20	2·60	5 5 0	" " " "

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF SECRETARY FOR AGRICULTURE UNDER THE ARTIFICIAL MANURES ACTS—*continued*.

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Mechanical Condition. Fine.	Mechanical Condition. Coarse.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	%	£ s. d.	
ntaining Phosphoric Acid and Nitrogen, Phosphoric Acid moderately Soluble.							
nedust	Lara . ..	3·50	19·10	32·80	67·20	5 5 0	J. W. Branch, Geelong
,, ...	Ox . ..	3·15	22·00	33·00	67·00	6 0 0	J. L. Brown, Hamilton
nemeal	Sickle	3·00	21·00	30·00	70·00	7 0 0	Cuming, Smith, and Co. Prop. Ltd., Melbourne
nedust	Elsworth	4·00	19·00	30·00	70·00	6 10 0	Exrs. J. R. Elsworth, Ballarat East
,, ...	Horseshoe	3·75	15·40	52·20	47·80	5 0 0	P. Fitzgerald, Bentleigh
,, ...	Hasell's	4·75	19·00	55·00	45·00	7 5 0	A. H. Hasell, Melbourne
ne and Blood	,, ...	5·50	17·00	40·00	60·00	7 10 0	,,
nedust	Bullock	2·00	17·00	30·00	70·00	6 0 0	Heinz Bros. Prop. Ltd., Ballarat
,, ...	Vauxhall . ..	3·86	23·25	33·70	66·30	6 10 0	Wm. Moore, Panmure
nemeal	M.L.	3·00	21·00	30·00	70·00	7 0 0	Mt. Lyell M. and R. Co. Ltd., Melbourne
nedust	White Horse ..	2·50	24·30	60·00	40·00	5 0 0	F. W. Richards, Warrenheip
,, ...	Rohs	4·00	18·00	66·00	34·00	5 15 0	P. Rohs, Bendigo
,, ...	Brown Hill ..	2·50	18·00	30·00	70·00	6 0 0	Turner Bros., Ballarat East

vernment Agricultural Laboratory,
21st November, 1912

P. RANKIN SCOTT,
Chemist for Agriculture.

COOL STORAGE ON THE FARM.

By G. H. F. Baker, Dairy Supervisor.

During the hot summer months many farmers find it difficult to keep their cream, even when sent daily to the butter factory, in that condition which is essential for the production of superfine butter and as quality is one of the factors which determine price, it is to their interest to supply the factory with a fresh article. To do this it is necessary, immediately after separating, to reduce the temperature of the cream as low as possible, and keep it so. Without the aid of a refrigerator or ice this is a difficult matter in most cases.

On some farms, in country like the Beach Forest, where springs are abundant, water is conveyed by pipes from the spring to the water tank and the cream cans placed in running water of a low temperature.

Another but less efficient method is to stand the cans in water; but as the water absorbs heat from the atmosphere it is not many hours before it becomes almost as hot as the air and the good effect nullified, with consequent deterioration in the quality of the cream and low price for same.

A cheap and effective cool safe that has proved a perfect boon in the hot, dry districts can be made at a little cost with a few battens, some hessian, and sufficient galvanized iron to make a shallow dish. This safe will keep the cream fresh, and prevent contamination by flies, dust, &c. The size will depend upon the quantity of the material required to be stored. The builder will, therefore, be wise if he constructs a safe somewhat larger than the anticipated necessary requirements. It will cost little more, and guard against overtaxing the accommodation during the months of heavy production.

The principle of the safe described in this article is the same as occurs in the canvas water bag which as is well known keeps the contained water at a much lower temperature than the surrounding atmosphere by virtue of the evaporation taking place. In this safe water is syphoned from a basin on the top—by means of strands of wool—this flows over the hessian lining keeping it continually moist and the contents cool and fresh.

Such a safe will prove a boon to the women folk by adding to the comforts of farm life in keeping the meat, butter, milk, and other perishable products fresh and cool in the hot, dry months of summer. As it is not wise to store anything else in the same safe with the cream, it would be advisable to make two—one for cream storage and one for other products.

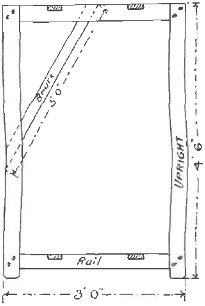
METHOD OF CONSTRUCTION.

All the material is constructed of 3-in. x 1-in. uprights and rails, and 2-in. x 1-in. braces.

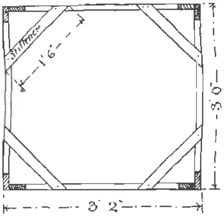
Each side consists of two uprights 4 ft. 6 in. long, two rails 3 feet long, and one brace 3 feet long. The brace for framework of front in which door is hung will be only 18 inches long, and will act as stop to door.

The uprights and rails are framed together as shown in drawing No. 1; the joints are halved together and screwed with two screws to each joint, and the brace is firmly screwed on the back.

The four sides having been made are placed together, forming a square 3 feet x 3 ft. 2 in., as shown in drawing No. 2; the sides are nailed together at the corners, and each corner is stiffened at top



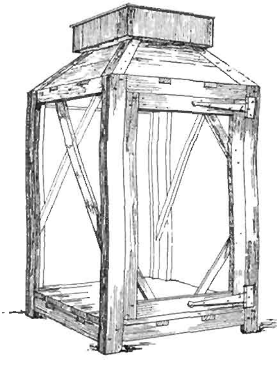
No. 1



No. 2

and bottom by a brace 1 ft. 6 in. long let flush into top of rails and nailed thereto with 2-in. nails.

The floor is formed with 6-in. x ¾-in. tongued and grooved boards nailed on top of rails with 2-in. nails.



No. 3

The top is to be formed, as shown in drawing No. 3, of 6-in. x ¾-in. The sloping sides are supported on eight triangular pieces 1½ inch thick, well nailed to top of rails and stiffeners. In order to save the

labour of carefully mitreing the angles so as to keep the water out of the safe, it will be necessary to cover the joints with a strip of galvanized iron.

The door is constructed in the same manner as the sides, but with two short braces, as shown in drawing No. 3, to be hung on a pair of 12-in. T hinges and fitted with turn button or other fastener.

In order to catch the drip when door is opened, a small gutter made of light galvanized iron should be hung on galvanized iron staples to inside of top rail of front. It should be so hung that when the door is opened the gutter will swing forward sufficiently to catch any drips, and the door in closing should push gutter back.

A small gutter made of galvanized iron should be fixed with galvanized iron clouts to outside of bottom rails with a fall to the corner most convenient for running the water off.

The basin on top may be any watertight vessel, into which strands of wool are placed to syphon the water out on to the hessian.

All the drawings, for the sake of clearness, show the framework without any covering. All the framework is to be covered externally with hessian fixed to rails and uprights with copper tacks.

THE FRUIT TRADE OF VICTORIA:

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page 671, Vol. X.*)

By E. Meeking, Senior Inspector of Fruit.

PART III.—INTER-STATE TRADE.

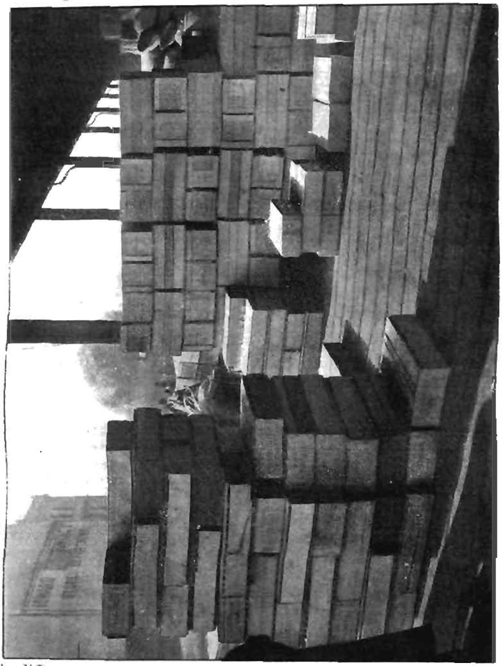
It would appear, from the reports of the proceedings of the Annual Conferences of Fruit-growers each year, that the importance of maintaining and further developing the Inter-State trade in fruit on modern lines is not apprehended as fully as its importance deserves. When it is considered that, as before stated, the export of fruits to other States of the Commonwealth in the year 1910-11 totalled 484.413 bushels, or 13.5 per cent. of the total fruits raised in Victoria during that year; and when it is realized that this quantity exceeded the quantity exported to all over-sea countries (including South Africa, the East, and New Zealand) by 196.116 bushels, it will be readily understood that the maintenance of the trade already established and its development on profitable lines are essentially important to the fruit-growing industry of this State.

Regarding the kinds of fruits exported to other States, it is worthy of note that these consisted principally of apples, cherries, pears, and plums; the quantities of these in bushels being as follow:—Apples, 112,031; cherries, 25.114; pears, 282,351; plums, 53,165. Total, 472,661 bushels. This left a margin of only 11,752 bushels of all other kinds of fruits.

Our best customers in this trade are the two northern States of New South Wales and Queensland, as more than two-thirds of the total exported in the year under notice were forwarded to these two States.

RAIL *versus* WATER TRANSPORTATION.

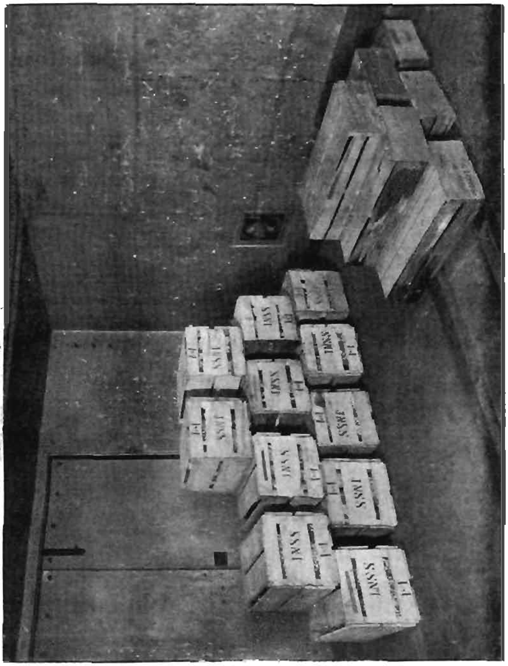
Owing principally to water transportation being cheaper than transportation by rail, the bulk of our fruits are consigned to other States by the various lines of Inter-State steamers which ply between Melbourne and other ports of the Commonwealth. The cost of water transportation is, under any circumstances, relatively cheaper than rail transportation; but, between Victoria and the northern States,



INSPECTED FRUIT AWAITING REMOVAL.

this difference is accentuated by the unfortunate break in rail gauge at Albury. This undoubtedly drives a considerable portion of the trade to the shipping companies; as the delay and extra handling of consignments at the border, combined with the added expense which this handling entails, introduces an element of risk into the business which the exporter usually does not care to accept. Rail transport is, therefore, chiefly availed of only when the exporter wishes to rapidly

transfer his fruits to the markets of the northern States during such times as extra good prices prevail, and when he wishes to reach these before a general rush of produce causes the prices to fall. This is to be regretted; as there is little doubt that, were the rail gauge uniform throughout, the traffic in fruit interchange by railway would be much augmented, for, under proper and up-to-date conditions, rail transportation possesses so many advantages over transportation by



FUMIGATING INTER-STATE FRUIT.

water that the extra cost of the former is more than counterbalanced. These advantages consist of rapid transit, and the estimation of the time almost to an hour when consignments will arrive on the intended markets. Owing to the perishable nature of most fruits, these advantages are of the utmost importance. However, in spite of the disadvantage of transfer at the border, it must be confessed that

fruits forwarded to the northern States by rail usually arrive in better condition than those shipped by water.

This is due to the fact that, in addition to the more rapid transfer which the rail confers, the shipping companies do not provide any compensating advantage by the adequate installation of refrigerator accommodation on the Inter-State steamers; so that if the small percentage of consignments which are shipped in the limited refrigerator space on these steamers is excluded, there is little doubt that the consignments sent by rail arrive in better average condition than those forwarded by steamer as ordinary cargo.

These facts, indeed, are quite realized by many of our leading fruit agents, who, notwithstanding the existing disabilities, prefer to transfer fruit consignments to other States by rail whenever such may be warranted.

BREAK IN INTER-STATE RAIL GAUGE A SERIOUS DRAWBACK.

The most serious aspect which the break of rail gauge between Victoria and New South Wales presents is the fact that as the populations of the northern States increase, and the markets for our fruits in these widen, the utilization of ice car service will be prevented, as the transfer of fruits at the border from one set of ice cars to another set would, especially during warm weather, cause such condensation and fluctuation of temperature in consignments as to render the use of this type of car worse than useless. If we are to be guided by the experiences gained on the North American Continent during the rapid and enormous development of the fruit industry there during recent years, the serious nature of this disability in the expansion of our trade with New South Wales and Queensland will be realized; for the pre-cooling of fruits prior to transport, the evolution of the refrigerator car, and its almost universal use in connexion with the transport of fruits to the various markets in America, may be reckoned as amongst the most important factors in the growth of the fruit trade in the United States and Canada.

NEED FOR BETTER METHODS OF TRANSPORTATION.

It is not only in connexion with land transportation that a dearth of up-to-date methods is manifest. The refrigerator accommodation on the Inter-State steamers is sadly behind the requirements of the trade. Only certain of the regular steamers are provided with refrigerator space at all, and even in these, the accommodation is so limited as to be of little practical utility to the trade as a whole.

It is not over-estimating the case to state that from 10 to 15 per cent. of consignments conveyed by Inter-State boats are lost before they reach the consumer through lack of cool storage accommodation during transit.

APPARENT ANOMALIES IN FREIGHTS.

What appears to be an anomaly, and one which would tend to act as a drawback to the development of the fruit export trade from Victoria to the other States, is the higher rates which are charged by the shipping companies on fruits shipped from Melbourne to many other

Australian ports than the return charges from those ports to Melbourne. This is shown by the list hereunder:—

INTER-STATE STEAM-SHIP FREIGHTS ON FRUITS.

Ordinary.

To Sydney, 10s. 6d. net from 10s. 6d. net	
To Brisbane, 22s. 6d. from 14s. 3d.	
To Maryborough, 29s. from 21s.	Subject to 5 per cent. rebate.
To Rockhampton, 30s. from 24s. 9d.	
To Mackay, 39s. from 27s. 6d.	
To Bowen, 39s. from 27s. 6d.	
To Townsville Jetty, 36s. from 24s. 3d.	
To Townsville, 39s. from 27s. 6d.	
To Ross Creek, 39s. from 27s. 6d.	
To Cairns, 54s. from 33s.	
To Cooktown, 60s. 6d. from 34s.	
To Port Douglas, 60s. 6d. from 34s.	
To Adelaide, 10s. 6d. net from 10s. 6d. net.	
To Albany, 34s. 9d. from 24s. 9d.	Subject to 5 per cent. rebate.
From Fremantle, 34s. 9d. from 24s 9d	
To Bunbury, 38s. 6d. from 27s. 6d.	
To Geraldton, 46s. 3d. from 33s.	

The above list shows the rate charged per ton measurement (23 cases per ton) on fruits carried as ordinary cargo. The rates charged

DELIVERING INTER-STATE FRUIT AT WHARF.

on fruits carried in refrigerator space are much higher than these, being from 10s. to 20s. per ton in excess.

The reason for granting preference in freight charges from other Australian ports to Melbourne seems hard to understand. It cannot be claimed that the concessions are wholly granted on the one hand to encourage an export trade from ports where such trade is small, or that granted to ports from which the trade is so extensive as to justify a reduced rate; as the average freight charges from Melbourne to most of the Inter-State ports is higher than the return charges from those ports to Melbourne, irrespective of the volume of trade in either direction.

For instance, although the exports from Albany, Fremantle, and other West Australian ports to Melbourne are practically *nil*; and the exports from Brisbane, Maryborough, and certain other Queensland to Melbourne exceed the exports from Melbourne to those ports, yet the freight charges to both the West Australian and Queensland ports are much higher than the freights from all those ports to Melbourne. These anomalies in rates are matters which our shippers of fruits to Inter-State ports might inquire into with advantage.

FUMIGATING MAIZE.

INTER-STATE SHIPPING CHARGES APPARENTLY TOO HIGH.

Apart from the question of the anomalous rates as mentioned above, the freight charges imposed generally by the Inter-State shipping companies for the conveyance of fruit between the different ports

of the Commonwealth seem much too high. Notwithstanding this, the matter has not been given the attention on the part of growers and shippers which its importance deserves, although much discussion has arisen during recent years regarding the freight charges imposed on fruits shipped to the United Kingdom and Europe, and the opinion has been freely expressed in many quarters that these charges (which average 65s. per ton) are too high. This is probably true; but what should be said of the Inter-State charges, which would appear by comparison with those levied on fruits shipped

AMERICAN PACKING SHOWING CORRECT AND EXCESSIVE BULGE.

to the United Kingdom and Europe little short of extortionate? This is the case with the freight charges from Melbourne to all ports of the Commonwealth, but the charge on fruit consigned in refrigerator space from Melbourne to Sydney will suffice for an example. This charge is 21s. 6d. per ton, or nearly one-third the freight charged from Melbourne to London, although the distance from Melbourne to Sydney is, roughly, only one-fifteenth the distance from Melbourne to London.

(To be continued.)

MILKING MACHINES—

There is, perhaps, no machine in use on the farm about which such diversity of opinion exists as the milking machine. Some farmers consider it a capital invention, and a great labour-saver; others would not have one about the place. The fact seems to be with this machine that success depends in rather more than ordinary degree upon the care and skill of the operator. A recent issue of *Hoard's Dairyman* puts the matter concisely:—"The milking machine has passed the experimental stage. Better results can be obtained from it when properly worked than from a certain class of milkers. We know of herds that have been milked for several years with the milking machine, and the owners are well satisfied with results. The trouble has been, in some instances, that people without any mechanical ability have tried to operate the milking machine, and, lacking in persistency and ingenuity, have laid them aside with the feeling that they were not sufficiently perfected to do satisfactory work."

WHEAT AND ITS CULTIVATION.

Continued from page 707, Vol. X.

No. 9.—WHEAT IMPROVEMENT.

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

One of the most remarkable and interesting features of modern agriculture is the extraordinary activity displayed in the subject of plant improvement throughout the world.

This extraordinary activity is very largely due to the rediscovery of Mendel's work by De Vries, Tschermak, and Correns, the epoch-making work of De Vries on the mutation theory, and the stimulus given through the establishment of schools of genetics in the older universities of the world.

Practically every agricultural crop of importance has been subjected to a critical study during the last decade, with a view of determining the best lines on which specific and desirable improvements may be brought about.

Systematic plant-breeding is a comparatively modern development. The reason is not far to seek. From the dawn of civilization, man's attention has been occupied with the improvement of his animals rather than his crops. Indeed, improvement in plants was hardly possible until the sexuality of plants was discovered, and the necessity of pollen in seed formation became known and generally understood. The discovery of sexuality in plants was only made in 1691 by Camerarius, and nearly half-a-century elapsed before the structure of the flower was properly appreciated.

Thus, while systematic mating of plants could not have been practised for more than two centuries, the control of the breeding of animals has been undertaken by man for over 2,000 years.

Though the practice of plant-breeding is quite a modern development, the amount of data already collected is sufficient to indicate that enormous possibilities lie ahead of this line of work.

The great improvements wrought in our flocks and herds by careful, systematic breeding is apparent to the veriest novice. The development of the Booth and Bates' types of Shorthorn cattle, the American trotting horse, and the Australian type of Merino sheep may be taken by way of illustration. No one nowadays would express the least surprise if a breeder of dairy cattle attempted to breed a herd of stock giving milk of unusual richness in butter-fat. It is so common a phenomenon now that it ceases to cause wonder.

But to set out with the definite intention of breeding farm crops, with the object of improving them in certain specific qualities, is still considered unusual enough to occasion considerable surprise. The fundamental principles of breeding and inheritance, however, are the same, whether they are applied to animals or to plants. Is it not perfectly rational then to assume that profound changes may be wrought in the vegetable world by the application of those principles of breeding which have brought individual flocks and herds to the high pitch of excellence of the present day?

Let it be remembered that the plant-breeder has at least one immense advantage over the animal-breeder.

He can work with hundreds of thousands of individuals, and can afford to make his selections with the utmost rigour, and take the very fullest advantage of the individual variations of type, which, as will be seen later, are the basis of all future improvement.

The animal-breeder, for many reasons of which not the least is the expense incidental to breeding and feeding of large numbers, must, of necessity, confine his attention to comparatively few animals, and the probabilities of securing wide and valuable variations are thereby considerably lessened.

IMPORTANCE AND AIM OF WHEAT IMPROVEMENT.

According to the Commonwealth statistics for 1910-11, of the total area under crop, namely, 11,893,838 acres, no less than 75 per cent. represented wheat and wheaten hay. The wheat of the Commonwealth

VIEW OF STUD SELECTION AND CROSSBRED PLOTS, RUTHERGLEN EXPERIMENTAL FARM, 1912.

for 1910 amounted to over 95,000,000 bushels, and the cash value, at 3s. 4d. per bushel, equals nearly £16,000,000. During the past decade the enriching and improving of the soil has been the dominant note in our system of wheat-farming. Attention has been concentrated on the use of fertilizers, improved methods of tillage, and the adoption of rotation adapted to the climatic and soil conditions. These improved methods of grain-culture have placed the wheat industry of the State and of the Commonwealth in a very secure position. These important developments all aim at improving the soil conditions, or what might be termed the plant's environment, by bringing within the range of root action a plentiful supply of those elements essential for the welfare of the crop.

In the near future, however, there is reason to believe that greater attention will be directed to the improvement of the wheat-plant itself, and to the production of varieties adapted to specific conditions and

requirements. The possibilities ahead of such activities are obvious. If, by any process of plant improvement, the average yield of a given variety of wheat could be increased by only 1 bushel per acre, it would mean that the farmers of this State would reap £500,000 more each year, without a single cent extra being spent either in cultivating or manuring the land.

A quality of prime importance that should be developed to the full in Australian wheats is drought-resistance. The varieties of wheat brought with the pioneers from the Old Country were not drought-resisting in character. Accustomed for centuries to growing in relatively cool climates, with abundant rainfalls, these wheats had developed qualities which unfitted them for growing in the drier parts of Australia. Eighty-five per cent. of the wheat of Victoria is grown north of the Dividing Range, and a large portion of this is grown in relatively dry districts. If ever the drier parts of Australia lying beyond the present margin of cultivation are to be brought under the plough, the cultivation of drought-resisting varieties will be a fundamental pre-requisite. Varieties are needed in these areas which possess a short growing period, *i.e.*, rapidly-maturing wheats which will make the most of our short winters, and which produce a maximum of grain and a minimum of flag. Other properties of prime importance are the milling qualities of the grain, and the colour, strength, and gluten content of the flour. The present practice in Victoria is to sell all wheat on the basis of one grade, f.a.q. This practice obviously does not encourage a farmer either to grow grain of high quality or pay any special attention to the cleaning of the sample. The time is not far distant, however, when wheat will be sold on grade, just as is done with butter, cream, fruit, and other produce.

Before a wheat can be considered of high milling quality, it must be satisfactory in three respects—(1) colour, (2) gluten content, (3) strength.

The flour made from the wheat must be such as to make bread of snow-white colour, in order to satisfy the demands of the consumer. So long as this demand for snow-white colour continues, so long must both miller and baker consider the question of colour of great importance.

Incidentally, it might be mentioned that Victoria has always been able to produce wheats which, on milling, give a flour of excellent colour, and it is principally on this account that these wheats meet with such a ready sale on the English market. We cannot overlook the fact that, generally speaking, the varieties commonly grown are wanting in strength and gluten content. It may be that these deficiencies are a characteristic of the climate, and, if so, we might be inclined to infer that improvement in these respects is beyond the limit of possibility. While it is true that these important qualities are in a large measure dependent on the climate, there is every reason to believe that they may be developed in our wheats to a much more satisfactory degree than at present.

Convincing evidence of this may be seen in the case of Comeback, Bobs, and Cedar—varieties of exceedingly high strength—which have been bred and developed by the late Mr. Farrer under Australian conditions.

The great objection to these varieties is, however, that under ordinary farming conditions their yields are not satisfactory, so that, in spite of the enhanced prices which may be obtained for them, they are hardly as profitable to the farmer as the commoner but more prolific varieties. The interest of the farmer demands that the varieties of wheat grown by him should be prolific, rust resistant, and relatively drought resistant.

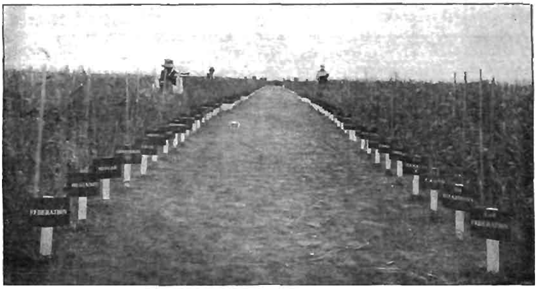
It is to the miller's interest that the varieties grown should give a good yield of flour of good colour.

It is to the baker's interest that the flour should be of high strength, so that he may make the maximum of loaves of bread per sack.

It is the wheat-breeder's task to produce a variety which will completely satisfy the farmer, the miller, and the baker.

WHEAT BREEDING IN OTHER COUNTRIES.

Before discussing the methods whereby these specific improvements may be made, it may be of interest to briefly review what is being done in other countries.



STUD SELECTION AND CROSSBRED PLOTS, LONGERENONG AGRICULTURAL COLLEGE, 1912.

Systematic breeding of wheat and other cereals has been practised for many years past in the United States, Canada, Germany, France, Sweden, Britain, and India.

A large number of agricultural experiment stations and colleges in the United States are at present engaged in breeding new varieties of wheat. The Minnesota station has originated numerous varieties, two of which have "yielded from 1 to 3 bushels more per acre than the varieties formerly grown."* Other stations, particularly Maryland, North Dakota, California, and Ohio, have done much valuable work in the production of new varieties and the improvement of existing types.

In Canada most of the breeding and selecting of wheat has been done in connexion with the Dominion Experiment Farm system on the central station at Ottawa. Dr. William Saunders (now

* Year-book of the Department of Agriculture 1908, p. 155.

Director of Experiment Farms) began the work of wheat improvement in Canada in 1888. Working on the Red Fife wheats, he succeeded in producing the cross-bred varieties—Stanley, Preston, Huron, Marquis, and Bishop—which are now widely grown throughout Canada.

In England, Biffen, of Cambridge, has done a large amount of work in wheat improvement. Biffen has paid special attention to the production of a variety of wheat combining the important qualities of (*a*) high yielding capacity of the English varieties; (*b*) the high strength characteristic of the Manitoba wheats; and (*c*) immunity from yellow rust (*Puccinia glumarum*). He claims to have achieved considerable success in this direction.

In Sweden, the wheat breeding is concentrated at Svälof under the direction of the Swedish Grain Society. This society has done a vast amount of good in introducing superior varieties of wheat in Swedish agriculture. No less than fifteen trained plant specialists are engaged in this work. Details of this institution will be discussed later.

In Germany, a large number of public and private institutions are engaged in the improvement of cereals and root crops. According to Hillman,* there are no less than 84 breeders engaged on the improvement of wheat, 46 of rye, 65 of barley, 53 of oats, and 44 of fodder and sugar-beets.

A considerable amount of work has been done in India towards the improvement of local wheats by selection and crossing. It is interesting to note that many Australian varieties have been tried by the Indian Government, in the hope that these would be of direct value under Indian conditions.

Among others, Purple Straw, White Tuscan, Frampton, and White Essex were tried at Lahore,† Lyallpur, and Hyderabad from 1893-1894 to 1900, but the results were not satisfactory. It is also interesting to note that in 1900, W. H. Moreland, the Director of Agriculture of the United Provinces, was deputed by the Government of India to visit Australia and study Farrer's methods.‡ As a result of his visit, a wheat-breeding station was established at Cawnpore in 1902 by the Indian Government. In addition, centres for wheat breeding were established at Pusa, Lyallpur, and Poona.

WHEAT BREEDING IN AUSTRALIA.

The outstanding feature in wheat-breeding work in Australia is the remarkable success achieved by that patient and retiring genius—the late William Farrer, of New South Wales—in every branch of wheat improvement.

A man who could set out clearly and comprehensively as Farrer,§ both the goal towards which he was striving in his work of wheat improvement, and the methods whereby he hoped to reach that goal, and in less than a decade flood the market with varieties like Federation—the most prolific and popular farmer's wheat in the Commonwealth; Bobs, and Comeback—of unsurpassed milling excellence; Florence and Genoa—bunt-resisting varieties; and a host of others.

* F. Hillman, Arb. Deut. Landw. Gesell. (1910) No. 168.
† Reports of the Government Horticultural Gardens, Lahore, and the Lyallpur Farm, 1893–4 *et seq.*
‡ Moreland Agricultural Ledger, India (1901).
§ Farrer: The making and improvement of new varieties of wheat for Australian conditions. *Agricultural Gazette* (N.S.W), February, 1898.

enjoying widespread popularity, such as Bunyip, Thew, Bayah, Warren, Genoa, Firbank, Cleveland, Cedar, Jonathan, etc., must have possessed in an unusual degree the insight of genius. It is no exaggeration to say that Farrer has added millions sterling to the national exchequer by the creation of Federation wheat. Dr. Cherry estimates the cash value of Farrer's work to Victoria alone during the 1909 season at £250,000.* Since that estimate was framed, the area sown with this popular variety in Victoria has greatly increased, and the benefits have become commensurately greater.

Farrer's work was continued by Mr. G. L. Sutton—late Wheat Experimentalist of New South Wales—who did a great deal to popularize the Farrer varieties amongst farmers.

In this State, Mr. H. Pye, the present Principal of Dookie Agricultural College, has been the most prominent investigator of the problems connected with the improvement of wheat varieties. For many years he collaborated with Farrer in the testing of new varieties, and the independent work he has done has resulted in the production of a number of crosses possessing improved qualities, which are now undergoing the process of fixing and testing on a commercial scale. The work of producing new varieties of value is necessarily slow and tedious, and the results of Mr. Pye's long and patient work will doubtless be of immense benefit to wheat-growers.

In South Australia, the improvement of varieties by selection and cross-breeding is carried out at the Parafield Wheat Research Station and at the Roseworthy College. The demand for improved and selected cereals from both these centres has for many years past greatly exceeded the supply.

Many of the varieties grown in the wheat areas of the Commonwealth were originated by private farmers. With one or two exceptions, these varieties were obtained by selection from the ordinary crop. Among many of the varieties that might be mentioned are Dart's Imperial, Marshall's No. 3, Correll's No. 7, King's Early, Yandilla King, Steinwedel, Petatz Surprise, Carmichael's Eclipse, and Huguenot. In most cases these varieties originated from a single plant growing in the ordinary field crop. The outstanding qualities of these plants arrested the attention of the originator, who harvested them separately, and multiplied the seed for distribution.

HOW IMPROVED VARIETIES MAY BE OBTAINED.

There are two general methods by which improved and new varieties may be obtained, namely, by—

1. Selection.
2. Cross-breeding.

We will consider each of these in some detail.

It must be borne in mind that in a young country like Australia many varieties of value may possibly be obtained from the older agricultural countries of the world, where wheat is grown under conditions not unlike our own.

Some preliminary acclimatization is usually necessary in these cases. How far such introductions are likely to be of value to us will be considered later.

* *Journal of Agriculture*, Victoria, 1909.

SELECTION.

Vilmorin, a renowned authority on plant breeding, states that "selection is the surest and most powerful instrument man possesses for the modification of living organisms."* Reduced to simplest terms, it consists merely in the choice of the best individuals for the propagation of seed, and it is by means of selection exercised through centuries that our cultivated plants have reached their present standard of excellence. The obvious effects of selection may perhaps be seen to best advantage in the animal world. It was by patient, systematic selection, exercised over a long period of years, that the famous Booth and Bates types of Shorthorn cattle were developed. What we term pedigreed stock in Merinoes, Clydesdales, Jerseys, &c., have been produced by a slow, painstaking process of selecting the very best animals in the herd, accompanied by a vigorous exclusion of the culls. While the vast majority of farmers are well aware of the beneficent effects of selection in the animal world, they appear to be totally oblivious of the fact that selection can be equally effective when applied to the plant world.

The term "selection," as commonly used, covers a general, as well as a specific, idea. In its general sense, selection is practised by every good farmer when he chooses varieties of wheat that are best suited to his soil and climatic conditions, reserves the best portion of his crop for seed purposes, and takes good care to grade his seed well. No well-informed stock breeder would think of selecting as his parent stock any other than the best animals he can secure with the means at his disposal. Nor should any wheat farmer be satisfied with anything but the best of his crop for seed purposes. He should take the greatest pains to get, first, the right variety of wheat; second, well-developed seed; and third, the seed should be secured from the most vigorous plants. The latter point is very important.

With regard to the choice of varieties, it may be pointed out that the difference in yield between two varieties of wheat grown on the same farm, under precisely similar soil and climatic conditions, is frequently sufficient to pay the rent and interest on the land on which the crop was grown. This has been demonstrated time and again in departmental experimental plots and on private farms.

Carefully-conducted experiments in various parts of the world demonstrate that it pays a farmer to give careful attention to the selection of his seed.

In Canada, Zavitz† states that during twelve years' work at the Ontario Agricultural College, large, well-developed grain of winter varieties of wheat averaged 46.9 bushels per acre, as against 39.1 bushels from small shrunken seed, and with spring wheat the average yield from the well-developed, plump seed was 21.7 bushels, as against 16.7 of the small seed.

In Britain, the University College of Wales‡ reports that nearly double the yield was obtained from plump grain as against small grain.

Desprez, in France,§ after experimenting with a large number of varieties of wheat, draws the conclusion that the results are markedly in favour of large seed.

* Vilmorin Exper. Station Record XI., p. 19.
† Zavitz: *Journal of the Board of Agriculture*, June 1910, p. 35.
‡ Report of University College of Wales, 1899, p. 68–70.
§ Jour. Agrl. Prat. (1897).

Cobb (N.S.W.),* after an exhaustive comparison of seed wheat from 24 varieties, states that the increased yield obtained from well-graded seed is sufficient to justify the installation of first class cleaning machinery.

The results obtained at some of the American Experimental Stations are conflicting, but, wherever care was taken in the selection of seed, considerable increases in yield resulted. This was the case at Kansas, Nebraska, North Dakota, and Indiana experimental stations, whilst at Pennsylvania and Ohio no marked increases resulted.

From these various experiments it may be safely concluded that the best results will be obtained by the selection of well-developed, plump seed, from plants of strong vitality.

The term selection is generally more restricted in meaning. It has now acquired a technical significance, and implies the systematic choosing of specific wheat-plants for future reproduction, with the

SELECTION PLOTS IN EARLY SPRING, RUTHERGLEN EXPERIMENTAL FARM, 1912.

object of bringing about an amelioration of type. It recognises that there are endless variations of type in an ordinary wheat crop—that there are grades of quality in wheat just as there are grades of quality in fruit and butter.

Selection seeks to isolate those types of plant which approximate most nearly to the ideal, and to systematically choose from the produce of these types the variations which are likely to be of material value.

This is the manner in which most of the improvements in our field crops have resulted.

UNCONSCIOUS AND CONSCIOUS SELECTION.

Of course, many of the modifications effected in plants, through long years of cultivation are the result of unconscious improvement. This is exemplified by the development of the cabbage, cauliflower, and kohl-rabi from the woody perennial plant (*Brassica oleraceæ Linn.*), which is a native of Southern Europe. The cabbage is a modification of the leaf, the cauliflower of the inflorescence, and kohl-rabi of the stem of this plant, and their origin is due to long-continued selection of

* Cobb: *Agricultural Gazette*, New South Wales, 1903.

variations which were considered desirable, and not because the gardener consciously attempted to evolve these specific forms.

On the other hand, many instances might be quoted in which improvement has been effected by systematic breeding.

Perhaps the most striking case is that illustrated by the development of the sugar content in beets. By a process of careful, repeated, and systematic selection of individual plants of high sugar content, combined with the repeated testing of the hereditary powers of each individual plant, the common beet, containing from 6-7 per cent. of sugar, has been developed into the sugar beet, containing from 20-25 per cent. of sugar.

The value of this improvement must be obvious. It has enabled the beet-sugar industry in Europe and America to more than hold its own against the cane sugar produced by black labour in the Tropics.

A remarkable case of selection is referred to in De Vries'* work. In 1886, De Vries found at Loosdrecht a plant of clover bearing a few leaves with four and five leaflets. He commenced some experiments to fix this type of clover. By continuous cultivation and selection, he ultimately (1892) secured plants in which four and five leaflets on each leaf were common, and, strangely enough, for the first time several leaves appeared with six and seven leaflets.

It is very probable that no clover plant in the world ever possessed six or seven leaflets until De Vries commenced these experiments.

HISTORY OF WHEAT IMPROVEMENT BY SELECTION.

The idea of improving cereals by selection is of comparatively recent origin. The most notable of the early wheat-breeders were Le Couteur, of Jersey; Shireff, of Haddington; and Hallet, of Brighton.

Le Couteur, nearly a century ago, observed that an ordinary field of wheat appeared to be extremely variable, and concluded that some of the various types found in the growing crop would yield better than others. He isolated 23 distinct types, and grew them separately, and was successful in introducing several new varieties into general cultivation. One of these is still grown under the name of Talavera.

A Scottish agriculturist—Patrick Shireff—developed the celebrated Hopetown oats in 1832, and placed on the market four distinct varieties of wheat, all of which were extensively grown in his time. His method of procedure was to walk through his wheat fields at harvest-time, and mark any plants which stood out prominently from the surrounding plants. He isolated these plants, sowed them separately, subjected them to severe tests, and sold the seed of the most promising types.

It is very interesting to note that neither of these breeders adopted the principle of *repeated* selection. They simply isolated individual plants of promising appearance, and multiplied the seed of these types as rapidly as possible. There was but one initial selection, followed by rapid multiplication of the progeny. On this fundamental point they differed widely from Major Hallet, who began his work of selection in 1857. His method of selection was derived from his previous experience of breeding Shorthorn cattle.

* De Vries: "The Mutation Theory," Vol. II., p. 36 (1910).

He first introduced the principle of repeated selection. His method was to select each year the best grain from the best ear of the best plant he could find in his wheat-field, and to repeat this process for a number of generations. On 18th June, 1862, he inserted a full-page advertisement in the *Times,* describing his methods of breeding wheats. In this advertisement he states that his "pedigree wheat was bred upon the same principle of *repeated* selection which has produced our pure races of animals."

During his first five years' work, the length of the head was doubled, the number of grains in the head trebled, and the tillering capacity was increased fivefold.

The improvements effected were, in a measure, artificial, inasmuch as he grew his selected plants on the very best and richest garden soil. Nevertheless, his strains were a success, and greatly improved the harvests of his generation.

The same principle of repeated selection has since been very largely practised in Germany, and has been very successful. Rimpau, in particular, has applied this principle of gradual improvement by continuous selection to rye, and succeeded in developing the famous Schlanstedt rye, which is now grown throughout France and Germany.

Another interesting principle in wheat breeding has been advocated by W. M. Hays, formerly of the Experiment Station, Minnesota. Hays adopted what is known as the "centgener" method of judging the efficacy of a given selection. He judges the value of a plant, not by its appearances, for these may mislead the observer, but by its performances in a "centgener" plot—by the average yield of 100 typical plants. His method is to isolate promising types of plants, and test their hereditary power by measuring the yielding capacity of 100 typical plants derived from each selection.

Finally, it is necessary to consider briefly the method of selection adopted at the famous Swedish Experiment Station at Svälof, Sweden, It may be explained that this station owes its origin to a small co-operative village company, formed in 1886 by private farmers for the production of improved seed wheat, oats, and barley, and the testing of new and foreign varieties of grain.

By means of exhibitions of pure seeds and numerous inspections of the experiment fields where the new varieties were grown side by side with the common Swedish varieties, the Swedish farmers soon became convinced of the financial advantages accruing from the sowing of improved seed. The company soon prospered.

Another society was organized at Orebro on similar lines to that of the Svälof company, but the two amalgamated, and formed the Seed Grain Society for Sweden. It became affiliated with a number of agricultural societies throughout Sweden, and received subsidies from them, as well as an annual grant from the Swedish Government.

The combination of the experimental and commercial sides of the undertaking became very inconvenient, and in 1891 a separate company was formed for the sale of the improved grains, under the name of the General Seed Grain Trading Company of Sweden. The Society now conducts all the experimental work, and produces the new varieties, while the General Trading Company distributes the grain of the ameliorated varieties to the farmers throughout Sweden.

Mr. R. B. Greig,* one of the members of the Scotch Commission who visited Australia just two years ago, gives a most interesting account of a visit to this remarkable institution

He says: "The work at Svälof is based on two discoveries—first that among the farm crops there exist an indefinite number of elementary species which breed true; and secondly, that superior individuals among these species can be quickly recognised by certain morphological characters. The first discovery was almost an accident; the second was the result of painstaking and minute investigation, assisted by an elaborate system of record keeping.

The Swedish Society for the Improvement of Grain was founded in 1886 by land-owners interested in agriculture, its object being to produce, by means of systematic selection, new varieties of farm crops yielding returns both larger and of better quality.

VIEW OF CROSSBRED PLOTS, RUTHERGLEN EXPERIMENTAL FARM, IN EARLY SPRING, 1912.

At first it was handicapped by inadequate funds and inferior buildings, but some years ago fine laboratories and other buildings were erected at a cost of 80,000 kroner, or £16,000, and the present annual income is between £4,000 and £5,000, made up as follows:—

Government subsidy	£2,200
Agricultural societies	1,100
The Swedish Seed Co.	275
Members of the society	550
Sale of produce	275
	£4,400

By a comprehensive series of trials, the principle was firmly established that unit of selection is the single ear or head. Further investi-

gation brought out the fact that in an ordinary field of oats, wheat, or barley there were dozens of different types, most of which bred true. The next step was to discover the superior types, or those specially adapted for special conditions. It has been demonstrated that certain characters of apparently negligible importance are actually trustworthy indicators of the productive power of an individual and of its quality. This principle of correlation or association of characters has been found applicable to all farm crops, and while it sheds a brilliant light to guide the improvement of crops, and provides a short cut to success, it effectively bars any but the trained specialist from the speedy recognition of new varieties by selection."

It is now accepted as a principle that the improved and selected seed produced at Svälof should be grown in each of the climatically different districts of the country before the seed is distributed to farmers. Hence, branch stations have now been established at Ultuna and Alnarp, in addition to a number of smaller experimental centres in other districts, to enable the staff to ascertain the agricultural value of the new varieties under different conditions of soil and climate.

BASIS OF SELECTION.

It must be apparent from what has already been said that the possibility of improvement by selection rests on individual variation. There are no two plants or no two animals absolutely alike. To the man in the street each member of a large flock of merino sheep seems precisely the same as each other member of the flock.

To the shepherd or enthusiastic stock-breeder, however, each sheep possesses certain marks, peculiarities, and attributes which distinguish it from every other sheep in the flock. Plants likewise are variable, and Nature is always moulding the individual to fit some chink in its environment. Precisely the same difference may be detected by the skilled plant-breeder among a group of apparently identical wheat plants.

Cause of Variations.—The exact cause of these individual variations is not definitely known. Changes of soil, climate, methods of cultivation, changes in the food supply, and the struggle for existence are admitted to be important factors in inducing the variations. A prolific cause of variation is the "splitting of type" brought about by cross-breeding. This will be discussed in detail later.

ORIGIN OF SPECIES.

Usually the variations from plant to plant are only small. Occasionally, however, considerable variations appear without any apparent reason, and these variations are more or less stable in character, and reproduce true to type. These are what De Vries calls mutations.

Before considering how new or improved varieties may be produced by man, it is interesting to briefly note in passing how species and varieties originate under natural conditions. According to Darwin,* species and varieties originate by what he calls *natural selection.*

He showed that the individuals of a species differ from one another to a slight extent, and that many of these differences increased or decreased their chances of survival. If all the seeds produced in a

* Darwin: "Origin of Species" (1859).

year by a given species were to germinate, there would be far too many plants to reach maturity. A fierce struggle for existence, therefore, results between the individuals of the species, and the fittest survive and the unfit perish. *If the individual members of a species* were all identical we could only ascribe to blind chance the fact that some survive whilst others perish. But they are not alike. Some plants are hardier and stronger than others. Some have a well developed root system which enables them to get nourishment where others fail. The slightest difference among plants may mean the difference between life and death, and it is this fact which enables Nature to continue her selection. The weaker individuals are forced to the wall in the struggle for existence, whilst the stronger survive. As Darwin says, "Those plants, in the long run, survive which are best able to adapt themselves to their environment." In other words, those individuals survive which vary in such a way as to give them some advantage over their less fortunate neighbours. As a result of this struggle, the mean of the species would be changed to some slight degree. If the variation is continuous, more and more change would take place; the small variations would be cumulative, and ultimately a new species would be produced.

The mutation theory controverts the older doctrine that variations may be augmented by selection until the differences become morphologically great, and until they become fixed and able to reproduce themselves.

According to De Vries,* new species and varieties originate by sudden changes—mutations, or sports, as he calls them.

According to this view, species are not slowly and gradually changed into new forms, but new and distinct types arise suddenly from the parent form. The variety, as a whole, continues unchanged, but produces from time to time aberrant individuals or mutations, which breed true to type, and are the real sources of all progress.

De Vries† bases his theory on the peculiarities of certain seedlings of the Evening Primrose (*Oenothera Lamarckiana*) which he found growing wild at Hilversum, in Holland; and the large body of evidence which he has brought forward has done much to convince biologists that discontinuous variation was far more common than was formerly supposed. He emphasizes the fact that variations are of two kinds. (1) Small *individual variations* that do not reproduce or "come true," and are therefore assumed to be of no permanent effect in the evolution of the type. (2) *Mutations* or *sports* (heritable variations) which breed true to type, and which represent the starting point of new species.

In a word, the difference between variations and mutations is one of definition—the mutations breed true, the others do not.

The mutation theory does not deny the importance of selection as a means of improving agricultural plants, for, even if a mutation does appear, it may still be improved in its lesser features by careful and repeated selection.

METHODS OF SELECTION.

There are two general methods of selection adopted by plant-breeders—*mass* selection and *individual* selection.

* De Vries: "Die Mutations Theorie" Leipzig (1901).

Mass selection consists of the continuous and repeated selection of a number of the best grains, ears, or plants. It is based on Darwin's conception of the origin of species, and it is supposed that by the repeated selection of a number of élite plants each year, the race, as a whole, will be gradually improved.

De Vries denies that any permanent improvement can result from mass selection.

Fruwirth, on the other hand, affirms that mass selection does result in permanent improvement.

The effect of mass selection, as applied to oats, barley, and potatoes, has been strikingly demonstrated by Professor Zavitz at Ontario.* The following table summarizes the results of sixteen years' continuous mass selection on these crops:—

TABLE I.

AVERAGE YIELD in four year periods in bushels per acre of oats, barley, and potatoes, showing the effect of mass selection on self-fertilized and on vegetatively produced crops.

Crops.	1890–93.	1894–97.	1898–1901.	1901–05.
	Bush.	Bush.	Bush.	Bush.
1. Oats—Average for 8 varieties ..	74	79	83	100
2. Barley—Average for 8 varieties	50	54	63	63
3. Potatoes—Average for 8 varieties	120	216	218	249

Mass selection is most effective when the individual plant is made the unit of selection, and not the individual ear or the individual grain, for it frequently happens that large grains and large ears of wheat are found on relatively poor plants.

Mass selection thus practised tends towards improvement of the type by propagating from the best plants and excluding all the rest. It may, of course, happen that some of the selections thus made are superior because they have been grown under favorable environment. They may, for example, have received an extra amount of superphosphate through the irregular working of the drill, or they may have been favoured with more space to develop than the majority of plants in the crop. However, the repeated and rigorous selection of the best plants would gradually confine the choice to what might be termed the permanently superior plants, and the general character of the crop would gradually improve in the desired direction.

Mass selection has been practised with great success at the German experiment stations, and by such breeders as Rimpau, Drechsler, and Mokry. There are several different ways in which this method of selection may be applied. Whatever method is adopted must obviously involve as little labour as possible, and take up a minimum of time. To be completely effective, the selection must be continuous and uninterrupted, *i.e.*, the selection must be kept up year after year to counteract any tendency on the part of the wheat to degenerate.

A method which has the merit of being continuous and of requiring a small amount of labour is the following:—

A field of the variety which it is desired to improve by mass selection is carefully inspected at harvest-time, and sufficient

of the best-developed heads from robust, well-developed, prolific plants is selected to yield, on hand-threshing, about 5 lbs. of graded grain. *This seed may be sown at seed-time, say* in 1913, in one strip of the drill, on approximately one-tenth of an acre, as a "stud" plot. At harvest-time a similar process of selection of the best heads from the strongest plants in the "stud" plot is carried out, and the produce of the selection is reserved to form the "stud" plot of 1914. The balance of the "stud" plot of 1913 is harvested and sown as the "seed" plot of 1914 on an area of approximately 2 acres. In 1914 the process is repeated. The best selected heads of the 1914 stud plot become the stud plot for 1915, *and the balance of the stud plot becomes the "seed" plot of 1915.* The 1914 seed plot of 2 acres is harvested and sown on, say, 30-40 acres as a "bulk" plot for 1915, from which seed for the whole farm is obtained. Thus, after three years, the selection becomes automatic.

IMPROVED SELECTED OATS PLOTS, RUTHERGLEN EXPERIMENTAL FARM, 1912.

The small stud plot has been selected for three years, and represents the "élite" plants of a race which is gradually approaching a pedigreed character.

The full effects of the process would not be felt for at least three years—the time taken for the "stud" plot to become the "bulk" plot.

The method could be made more systematic by making the unit plot a single row of specially-selected plants, and rigorously selecting each season the very best plants of each row.

INDIVIDUAL SELECTION.

When the individual plant or ear is made the starting point, we

In this case the selection commences with a number of superior plants of a given variety, and the seeds from each plant or ear are separately planted, and kept under continual observation. This enables a strict comparison to be made of the progeny of each selection, so that in a few years the best strain in the original selections may be determined and multiplied for future use.

Nillson, at Svalöf, after subjecting the older methods of mass selection to a critical examination, decided to adopt the method of single-plant selection used by Shireff and Le Couteur, and has achieved a considerable amount of success. The method of procedure has already been described. As a principle, it is based on De Vries' conception of the origin of species, and it assumes that repeated selection is unnecessary.

Another example of individual selection is afforded by the method introduced by Willet M. Hays, of the United States Department of Agriculture. His method consists in isolating the most promising

SELECTED SEED PLOTS UNDERGOING TRIAL, RUTHERGLEN EXPERIMENTAL FARM, 1912.

types of plants in a crop, and of testing the efficacy of the selection by comparing the prolificacy of 100 plants derived from each of the strains so isolated.

For this purpose the produce from individual plants are sown in "centgener" plots. One hundred and forty-four seeds of each selection are sown in a square, with twelve seeds along each side. At harvest-time the outside border row is removed, and the remaining 100 plants are harvested, and the total produce obtained is taken as a measure of the prolificacy of a given strain.

Hays made a close study of variation in wheat, and found that those characters such as yield, which can be expressed in numbers, follow what is known as Quetelet's Law of Variability.

A simple illustration of Quetelet's law may be obtained by comparing the measurement of the height of 1,000 men of the same nationality. If 1,000 men be selected at random and arranged in a row in order of height, it will be found—

(*a*) the man in the middle of the line represents the average height of all men;

(*b*) a line drawn over their heads will diverge only very slightly from the horizontal throughout its entire length, falling gradually towards the end where the smaller men are placed;

(*c*) the line will rapidly curve upward near the upper end of the line where the tall men are placed, and will curve rapidly downward at the lower end where the shorter men are standing.

Hays* points out that if the individual yields of a large number of wheat plants of any given variety are arranged in order, a precisely similar curve may be obtained to that illustrated above. The great majority of the plants give only an average yield, a few give a very poor yield, and a few give an exceedingly high yield.

These latter are the plants which he uses for his future selections.

Hays states that in "each one thousand plants of wheat there are a few phenomenal yielders, and the method of single seed planting makes it practicable to secure these exceptional plants, and from these new varieties can be made."

Working on Fife and Blue stem varieties of wheat, which were largely grown in Minnesota, he succeeded in producing improved strains which gave yields of 15-20 per cent. more than the original types, and which have largely displaced them from general cultivation. Thus Minnesota 169 wheat was bred by a process of selection from a Bluestem variety commonly grown in Minnesota. During four consecutive years it averaged in field trials 4.9 bushels more than the parent type. In 1902 it was distributed in 4-bushel lots to 375 farmers, and reports showed that its average yield in 1903 was 21.5 bushels, as compared with 18.2 bushels average for the common varieties, *i.e.*, an increase of 3.3 bushels, or 18 per cent. Hays judges the efficacy of a given selection, not by qualitative differences, but by the quantitative factor—namely, the average yield of the progeny of each individual selection. This principle gives a far more satisfactory basis for work than the judging of a plant by its mere external characteristics, more especially when the end sought is an increase in prolificacy of a given variety rather than an improvement in some specific quality, such as milling excellence or rust resistance. It is therefore of great practical importance for those who are desirous of effecting improvements in prolificacy of our standard varieties of wheat.

Of course, in attempting an improvement in a given strain of wheat by any of the methods described above, care must be taken to avoid choosing those plants which excel their neighbours through merely accidentally favorable circumstances.

Irregular distributions of manure, variations in quality of the soil, and irregular seeding obviously lead to irregularities in the appearance of the individual plants, and considerable judgment is required on the part of the operator to decide whether the outstanding plants in a given crop really excel on account of individual excellencies or because they have been specially and accidentally favoured in the struggle for existence.

* Bulletin 62, Minnesota Experiment Station, U.S.A.

PLANT-BREEDING SOCIETIES.

There are a number of societies established in other parts of the world for the development and control of plant breeding. We are quite accustomed in this country to societies for controlling the breeding and registering the pedigrees of the various breeds of cattle, horses, sheep, and pigs, but there are no such associations in existence for the exercise of a similar control over plant breeding. The Ohio Plant Breeders Association may be regarded as typical of many associations which have been established for this latter work. According to the articles of constitution: "The purposes of this Association shall be to encourage the improvement of plants and provide for an official record for breeders who are giving special attention to this work." The establishment of these societies and the extensive support already given them serve to indicate how important plant improvement is regarded in those countries where agricultural practice has become highly specialized.

INTRODUCTION OF NEW WHEATS.

In a comparatively young agricultural country like Australia, the introduction of foreign varieties grown under conditions of climate not unlike our own is likely to lead to the acquisition of some useful varieties. In the first year of their growth the yields of foreign varieties grown under Australian conditions are invariably unsatisfactory and disappointing. They very rarely approach our local

FLOWER OF WHEAT (MAGNIFIED).

wheats either in prolificacy or general utility. It must be borne in mind, however, that what are termed our local wheats have been brought in the first instance from foreign shores, and that by prolonged cultivation under Australian conditions they gradually became adapted to their new environment.

This process is termed acclimatisation, and invariably takes some years. Before judgment can be finally pronounced, therefore, on the merits of any newly introduced varieties of wheat it is necessary to grow them for a number of years so that they may be given an

opportunity of adjusting themselves to local conditions. This is a universal experience. It always occurs wherever varieties of wheat are transferred to an environment totally unlike that in which they were produced. The process of acclimatisation may be hastened by artificial selection, *i.e.*, to sow the introduced seeds singly, and to propagate only from those plants which prove to be most healthy and to have thriven best under the new conditions.

Noteworthy instances of the rapidity of acclimatisation when thus assisted may be seen from experience at the Parafield Wheat Station, South Australia. A number of Canadian and American wheats were introduced six years ago, and grown in small test plots. At first the results were extremely disappointing, but latterly several of the varieties have given promise of excellent results and are finding their way into general cultivation.

Though it is probable that the introduction of new varieties from foreign climes may be of some direct value, there can be hardly any doubt that many newly introduced varieties will prove of great indirect value in the improvement of our local wheats. Thus in imparting such important qualities as the ability to *hold the grain, rust resistance, earliness of maturity, milling quality,* certain foreign wheats are likely to be of the greatest service.

By crossing varieties possessing these attributes with our local prolific types, new varieties may be produced which combine the prolificacy of the local type with the specific excellence of the introduced type.

Illustrations of this may be seen in the cross-bred plots at Rutherglen and Longerenong this season, where crosses of early maturing short-strawed Indian wheats with Federation have resulted in the production of new varieties which are at the same time considerably earlier than Federation and at least as prolific.

Again, several improved Minnesota varieties have proved themselves singularly free from rust for several years past, though most of the local varieties have been badly affected. The drawback to these varieties has hitherto been their somewhat late maturity. Crosses made between early maturing wheats like Bunyip and Gluyas with these late maturing varieties have resulted in the production of new types which combine early maturity and high rust resisting powers.

The introduction and continued testing of foreign wheats, therefore, must be looked upon as an important part of the work of wheat improvement in a young country like Australia, because some of the new introductions may on acclimatisation prove to be of considerable direct value; and because these foreign wheats often possess certain specific qualities, highly developed, which enable them to be used with advantage in improving our own types by cross-breeding.

CROSS-BREEDING.

The second method of improving and creating new types of wheats is that of cross-breeding. The discussion of the aim, methods, and the principles governing the work will, however, be considered in the next article.

(To be continued.)

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition. April 15 to Nov. 14.	Nov. 15 to Dec. 14.	Total to Date (8 months).	Position in Competition.
40	White Leghorns ..	S. Brown	897	141	1,038	1
28	,, ..	F. G. Eagleton ..	855	133	988	2
47	,, ..	J. E. Bradley ..	846	134	980	3
23	,, ..	W. McLister ..	853	123	976	4
31	,, ..	Geo. Edwards ..	846	128	974	5
20	,, ..	E. Waldon ..	832	137	969	6
9	,, ..	J. Spotswood ..	845	117	962	7
62	,, ..	R. W. Pope ..	813	136	949	8
1	,, ..	J. Campbell ..	806	130	936	9
37	,, ..	C. B. Bertelsmeier ..	791	134	925	10
25	,, ..	R. L. Appleford ..	774	142	916	} 11
70	,, ..	C. J. Beatty ..	789	127	916	}
39	,, ..	W. G. Swift ..	757	143	900	13
13	,, ..	W. B. Crellin ..	753	144	897	14
46	Black Orpingtons ..	H. A. Langdon ..	778	111	889	} 15
24	White Leghorns ..	Sargenfri Poultry Yards	765	124	889	}
48	,, ..	Griffin Cant ..	760	127	887	17
49	,, ..	W. Purvis ..	753	133	886	18
29	,, ..	J. B. Brigden ..	757	127	884	19
38	,, ..	R. Moy ..	750	132	882	20
14	,, ..	J. H. Wright ..	768	108	876	21
33	,, ..	H. McKenzie ..	722	150	872	22
45	,, ..	Wooldridge Bros. ..	783	85	868	23
50	,, ..	A. Ahpee	730	136	866	24
44	,, ..	A. W. Hall ..	732	131	863	25
2	,, ..	B. Rowlinson ..	736	122	858	26
61	Black Orpingtons ..	Jas. Ogden ..	756	101	857	} 27
7	White Leghorns ..	A. H. Padman ..	715	142	857	}
53	,, ..	H. Hodges	712	144	856	29
63	,, ..	Percy Walker ..	709	143	852	30
6	,, ..	J. B. Macarthur ..	729	122	851	31
3	Black Orpingtons ..	King and Watson ..	767	83	850	32
5	White Leghorns ..	J. H. Brain ..	695	133	828	33
15	,, ..	Mrs. Steer ..	717	102	819	34
42	,, ..	Mrs. Kempster ..	679	132	811	35
19	,, ..	Cowan Bros. ..	684	126	810	} 36
30	,, ..	Mrs. Stevenson ..	703	107	810	}
35	,, ..	C. H. Busst ..	695	109	804	38
10	R.C. Brown Leghorns	S. P. Giles ..	667	130	797	39
51	White Leghorns ..	H. Hammill ..	672	116	788	40
64	,, ..	H. Merrick ..	658	129	787	41
69	,, ..	Morgan and Watson ..	642	139	781	42
32	,, ..	S. Brundrett ..	634	143	777	43
56	,, ..	M. A. Monk ..	655	118	773	44
60	,, ..	Miss B. E. Ryan ..	642	125	767	45
65	,, ..	A. H. Thomson ..	634	128	762	46
54	,, ..	F. R. DeGaris ..	630	119	749	47
12	,, ..	T. H. Stafford ..	602	142	744	48
27	,, ..	E. Nash	610	130	740	49
43	,, ..	G. Purton	618	118	736	50
8	Black Orpingtons ..	D. Fisher	664	71	735	} 51
11	,, ..	T. S. Goodisson ..	614	121	735	}
41	White Leghorns ..	A. Stringer ..	601	127	728	53
57	,, ..	B. Walker ..	589	135	724	54
4	,, ..	J. Blackburne ..	596	123	719	55
52	Black Minorcas ..	Chalmers Bros. ..	581	127	708	56
58	White Leghorns ..	W. J. Stock ..	588	116	704	57
16	Silver Wyandottes	R. Jobling ..	619	82	701	58
66	White Leghorns ..	J. Moloney ..	551	143	694	59
55	Brown Leghorns ..	J. Mathieson ..	565	123	688	60
68	White Leghorns ..	W. J. McKeddie ..	536	126	662	61
21	,, ..	J. O'Loughlin ..	526	117	643	62
22	,, ..	W. N. Ling ..	520	118	638	63
67	Anconas	A. E. Manning ..	511	120	631	64
17	White Leghorns ..	S. Childs	477	141	618	65
59	,, ..	W. J. Seabridge ..	475	133	608	66
18	,, ..	B. Mitchell ..	509	82	591	67
34	,, ..	R. F. B. Moore ..	468	119	587	68
36	Old English Game	K. J. Barrett ..	466	108	574	69
26	.. .. ..	(Reserved) ..	—	—	—	..
		Totals	47,172	8,568	55,740	

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

H. V. Hawkins, Poultry Expert.

MONTHLY REPORT.—FOR MONTH ENDED 14TH DECEMBER, 1912.

The results obtained at the Burnley Competition during the period under review have been highly satisfactory.

Weather.—During the month heavy rain fell at intervals—a total of 417 points having been registered, but, on the whole, the weather has proved good for egg production, being remarkably mild for the season of the year.

The trees planted in each pen have made good growth during the past few weeks, and now provide splendid shade for the birds.

Feeding.—The late rains have been responsible for a good spring of grass, particularly lucerne, and this has been of great assistance to the birds, which are in splendid health.

The lines followed in feeding have been similar to those which appeared in the last report, excepting for one week, when low temperatures prevailed, a ration of maize was then added to the wheat and oats fed at night.

Broodiness.—The large number of White Leghorns that went broody (27) has been a feature of the last month; the heavier breeds were responsible for ten affected in a similar manner.

Mortality.—It is pleasing to record that the mortality list showed that one bird only—in pen No. 70—had to be destroyed. This was due to abnormal condition of the generative organs, three eggs being removed from her weighing over 12 ozs.

Mr. Samuel Brown's pen of White Leghorns continues to hold pride of place, with a total of 1,038 eggs. These birds are laying splendid eggs, of good size and shape, their average weight being a little less than 25 ozs. to the dozen. So far, this pen has not produced a single egg with soft shell; whilst during the month only four "soft" eggs were laid, and three "underweight." This condition cannot be considered as other than highly satisfactory.

On previous page are the detailed returns to Saturday, 14th December.

PLANTING AND RECONSTITUTION OF VINEYARDS.

Conditions governing the Distribution of Phylloxera-resistant Vine Rootlings and Cuttings.

In order to guard against misunderstandings, such as have occasionally arisen in the past, concerning the conditions subject to which intending planters of vineyards may purchase phylloxera-resistant vines from the Department of Agriculture, it is deemed advisable, in the present issue of the *Journal*, to clearly state these conditions.

In previous seasons it has occasionally happened that growers who have failed to lodge their applications within the required time have pleaded want of definite information as to the rules regulating the distribution, and have asked that special consideration be extended to them in consequence.

It may not be out of place to here remind applicants that the Department is situated very differently from a private nursery firm,

which conducts its operations for profit. The propagation and grafting of resistant stocks was undertaken solely in order to help the Victorian vine industry through the phylloxera crisis, by which it was threatened with extinction. Numerous difficulties have had to be surmounted, and considerable sacrifices have been made, vines being supplied to growers at a price which amounts to less than half of what it costs to raise them. In order to prevent disappointment, and to insure the help and co-operation of growers, conditions have been drawn up which intending applicants are earnestly requested to thoroughly familiarize themselves with. *They are warned that under no circumstances can any departure be permitted from the regulations governing the distribution as detailed below, nor can any request for special consideration be entertained.*

Resistant vines are supplied to intending planters in either of the following forms, and at the prices stated:—

Resistant rootlings, grafted with scions previously supplied by applicants, at per 1,000, £4.

Resistant rootlings, ungrafted, at per 1,000, £1.

Resistant cuttings, at per 1,000, 10s.

The conditions which applicants have to comply with necessarily vary for each of these. Before detailing them, the two methods by which a vineyard on resistant stocks can be established may be briefly outlined, mainly for the information of settlers in new districts. These are—

I. Field grafting of resistant rootlings, planted the year before.

II. Planting of nursery-raised grafted rootlings or bench grafts.

Field grafting implies the planting of the vineyard with ungrafted rootlings, which are grafted, the year following their plantation, with scions of the vine variety it is desired to obtain fruit from. Sometimes cuttings are planted instead of rootlings, but unless the season be a very favorable one, results are usually disappointing.

Plantation of Grafted Rootlings.—The term "bench graft" is due to the grafting being performed at a bench or table, in a workshop; the resistant cuttings thus grafted with European scions being subsequently callused in artificial heat and struck in a nursery.

Field grafting is the older method. In Europe it has been very largely superseded by the plantation of grafted rootlings, a more even vineyard being thus obtained in climates where a cold Spring is the rule; cold, wet weather causing many field grafts to fail. In the more temperate climate of Northern Victoria far more satisfactory results can be relied on, and field grafting can be confidently recommended to intending planters. Some practical vine-growers who have tried both methods on a large scale claim to have obtained equal, if not better, results from field grafting.

A common fallacy concerning field grafting must here be corrected. It is often thought by intending planters that they gain a season by planting already-grafted vines. This, however, is not the case. The already-grafted vine cannot bear fruit before the third season from plantation. The field grafted vine commences to bear fruit the second season from grafting. If planted on properly prepared land, field

grafting can be executed the season following plantation; it therefore follows that such vines will commence to bear the third season from planting, or just as soon as the already-grafted vines, planted at the same time.

SELECTION OF SCIONS.

Scions for bench-grafting must be supplied by applicants for grafted rootlings, as will be pointed out presently; but it is well to here urge on intending planters the very vital importance of careful selection of scions, whether these be intended for bench or field grafting.

The improvement of the fruit-bearing capacity of a variety by means of careful selection of cuttings is no new discovery; it has repeatedly been recommended by different officers of this Department,* and its importance is now very generally recognised. It is a point, however, which was for many years much neglected by the majority of Victorian vine-growers, with the result that several of our vine varieties show more or less marked deterioration in their yield of fruit.

In order to secure prolific scions, the best individual vines in a block of any given variety should be carefully marked—quality and quantity of fruit, as well as general health and vigour, are the essential points to be considered in the selection of these scion-bearing vines, which may best be carried out immediately before vintage. Only fruit-bearing canes on the vines thus selected should be used as scions.

APPLICATIONS FOR GRAFTED ROOTLINGS FOR DISTRIBUTION, 1914.

(*For the* 1913 *distribution, the time for receiving applications closed on* 31*st May*, 1912, *and present applicants cannot be supplied till* 1914.)

1. For the 1914 distribution (June to August inclusive) applications must be made before 31st May, 1913, after which date they cannot be entertained.

2. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal Viticultural College, Rutherglen. They must be accompanied by a deposit at the rate of £1 per 1,000 grafted rootlings ordered. In the event of the allotment not being equal to the number applied for, the excess deposit will be applied as a progress payment for those delivered.

3. Scions for grafting, to the number of rootlings applied for and selected as described above, must be delivered by applicants at the Wahgunyah Nursery, or at the Wahgunyah railway station, freight prepaid, *between 1st and 30th June, 1913.* They must be of medium thickness (minimum diameter at small end ¼ inch and maximum at large end ½ inch), and must be delivered *in fresh condition and in* good order.

4. On orders for small lots (less than 500 of one scion or stock variety) a surcharge must be paid, to cover cost of extra supervision, of 25 per cent. for lots of 100 and over, and of 50 per cent. for lots below 100.

5. Applicants who supply resistant cuttings (stocks) as well as scions will be entitled to the full number of the grafts which strike.

* See *Journal of Agriculture*—Victoria, 8th March, 1906, p. 189.

6. Prior to distribution applicants must submit the land they intend to plant to inspection, as no grafts will be distributed unless the Department is satisfied that they will be planted on properly-prepared land.

7. The number of grafted rootlings applied for will, before being approved, be subject of adjustment after inspection as provided in the next preceding rule, and in the event of the approved number applied for exceeding the number available, distribution will be *pro rata* of the adjusted and approved quantities.

8. Applicants must pay the balance of purchase money, as specified above, together with cost of packing (of which they will be notified) before the grafts can be forwarded.

9. The nurseries in which grafted rootlings are raised being situated in phylloxerated districts, these cannot be supplied to growers in clean districts. To do so would be manifestly unfair to owners of existing vineyards in such districts.

APPLICATIONS FOR UNGRAFTED ROOTLINGS.

I. For the 1913 distribution (July and August inclusive) applications will be received until 30th June, 1913.

II. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal Viticultural College, Rutherglen. No deposit is required, but payment in full at the rate of £1 per 1,000, with cost of packing added, must be made before the vines can be delivered.

III. Orders for small lots (under 500 of any one variety) to pay a surcharge of 25 per cent. for lots of 100 and over, and of 50 per cent. for smaller lots.

IV. Should the number applied for exceed the number available, distribution will be made *pro ratâ*.

V. Rootlings cannot be sent from nurseries in phylloxerated districts to clean districts. A limited number of clean rootlings are, however, available for distribution to clean districts. The price charged is £1 10s. per 1,000, packing extra. Applications for these will be received by Mr. E. E. Pescott, Principal, School of Horticulture, Burnley, until 13th June, 1913.

APPLICATIONS FOR CUTTINGS.

In the event of not being able to purchase sufficient rootlings (grafted or ungrafted), applicants are reminded that cuttings are available. These may be either planted out immediately in the situation which they are intended to permanently occupy, or they may be previously struck in a nursery; the latter is the course recommended. The distribution of resistant cuttings is subject to the following conditions:—

1. In view of the urgent demand for grafted rootlings, no cuttings of sufficient diameter to be grafted are available for sale. Resistant cuttings of less than ¼ inch in diameter at the small end will be supplied at 10s. per 1,000.
2. Applications for such cuttings, for delivery in July and August, 1913, must be made prior to 30th June, 1913.

3. Applications may be made to the Director of Agriculture, Department of Agriculture, Melbourne, or to Mr. G. H. Adcock, Principal of the Viticultural College, Rutherglen. Payment in full, at the rate of 10s. per 1,000, with cost for packing added, must be made before the vines can be delivered.
4. Clauses 3 and 4 of the regulations concerning ungrafted rootlings apply also to cuttings.
5. Cuttings from phylloxerated districts cannot be sent to growers in clean districts. A limited number of cuttings are available in districts free from phylloxera, and these can be obtained subject to the conditions specified above, but at the increased price of 15s. per 1,000.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, Principal, School of Horticulture, Burnley.

The Orchard.

SPRAYING.

The codlin moth pest should still be fought, and spraying continued to keep it in check. The spraying tests carried out at Burnley last year seem to show that the earlier sprayings are the more valuable, and that very good results were obtained by spraying when the apples were in their young stage of growth. This was shown in the last November *Journal*. At the same time, the second brood will now be maturing, and it will be necessary to spray in order to preserve the fruit from its attacks. As well, all fallen fruit should be destroyed. Pear and cherry trees should be sprayed wherever the pear slug is present, even if there is no fruit on the trees. Japanese plums should also be watched in case the slug should attack these trees.

CULTIVATION.

The unseasonable rains of November and December have given orchardists an excellent chance to work up their ground. The soil is now in very suitable condition for surface cultivation, and the harrows, disc cultivator, or scarifier should be kept going to keep up a good condition of surface looseness. Even where the soil had been previously well cultivated, the cultivators should be again run over the surface, as any succeeding hot weather will cause the soil to form a crust, which would be the means of dissipating a very considerable amount of soil water. Every effort should be taken to retain this moisture, so that the fruit crops shall have all they require for their perfection. To further attain this end no weeds should be allowed to grow in orchard soils.

A good watering, if water be available, should be given to the trees that are maturing their fruit. It is not wise to be sparing of water at this time. A tree that is growing, and carrying fruit, needs all the stimulus that can be given to it in this way. The tree is more likely

to set strong fruit-buds for next season, in addition to perfecting this season's crop of fruit, if sufficient moisture be given to it. Over irrigation should be guarded against, especially in stiff and undrained soils. So long as a tree is growing well, and producing fair average and good quality crops of fruit, the water should be applied but sparingly. The problem to be decided by each grower is, what is the minimum quantity of water to give a tree, in order to produce the maximum results; and this can only be definitely solved by a knowledge of local soil, temperature, and rainfall conditions.

BUDDING.

Young trees, or old trees that have been previously cut down in preparation for budding, may be worked over towards the end of the month. It is advisable to select dull, cool weather for this operation, so that the sap may run more freely, and so that the weather will not have too drying an effect on the bud. The operation of budding is a very simple one, and is easily performed. To gain a successful end, the sap should be flowing freely, so that when the cuts are made the bark should "lift" or "run" easily, and without any clinging or tearing of the fibres; and it should separate freely from the wood. The bud selected should be firm and well matured, and should show no signs of premature growth whatever. It is cut from the scion with a shallow cut, and if any wood in the cutting be left in, this should be taken out of the bud. A smooth clean spot should be selected on the bark of the stock, and a T-shaped cut made; the vertical cut being longer than the horizontal one. The bark at the point where the cuts meet should be raised, and the bud inserted between the bark and the wood of the stock. The bud should be gently pushed down into position, and it should then be bound with soft twine, string, or raffia. If the bud be too long for the cut, the top may be cut off level with a horizontal cut. With practice, it will soon become possible to cut buds that will need neither cutting nor trimming.

After two or three weeks the buds may be examined to see if they have "taken"; that is, if the bud has united thoroughly to the stock. When that occurs the tie may be cut. If a growth be desired at once, all wood above the bud may be cut off some short distance above the bud, so as to prevent any bark splitting and consequent loss of the bud, and so as to throw the bud out at a fair angle. Ultimately, this should be properly trimmed.

If desired, the bud may be left dormant throughout the autumn and winter till next spring. In this case, the branch above is not cut off, but is left on until the usual winter pruning.

SUMMER PRUNING.

The profuse rains of November and December have caused a very vigorous growth in the fruit trees by considerably prolonging the growth period. In order to more economically utilize this abundant growth, it should be now summer pruned, particularly on the apple and pear trees. Care should be observed that as much of the leafage as possible is retained on the trees. Unduly long laterals of fruiting

trees may be shortened back, always cutting to a leaf. Unnecessary terminal leader growths, of which there are sometimes three or four, all strong growing, may be reduced to one; retaining this one as a leader. In no case should this growth be cut or interfered with in any way.

The results of these cuts will be to divert the sap which was flowing into growths that would subsequently be pruned into more profitable channels, so that weak buds and growths may be strengthened, and induced into fruit bearing.

Vegetable Garden.

The work in this section is much the same as in the flower garden. Frequent waterings, good mulching, and regular soil stirring will be the work for the month. As soon as any bed is cleared of vegetables, it should be manured and well dug over in preparation for the next crop. Deep digging is always desirable in vegetable growing. If any pest, such as aphis, caterpillars, or tomato weevil have been present, it would be advisable to burn all the crop refuse, to destroy any insects that remain, and to give the plot a good dressing of gypsum or of Clift's Manurial Insecticide.

Keep the tomatoes well watered and manured, pinching out surplus and strong-growing laterals. In early districts the onion crop will be ripening. In late districts, or with late crops, the ripening may be hastened by breaking down the top. An autumn crop of potatoes may be planted. Cabbage, cauliflower, lettuce and celery plants may be planted out.

Flower Garden.

January should be a busy month in the garden. The waterings will be constant and frequent; and after every watering the surface should be well loosened and stirred with the hoe, to keep it moist and cool. More cultivation and less water is a good rule to be observed. If the hoe be used more and the hose less in summer, greater benefits will accrue, and the water bill will be considerably reduced. Mulchings with straw, grass, &c., are very useful just now. The mowings from lawns form valuable mulching; waste tobacco stems are also valuable as a mulch.

Dahlias, chrysanthemums, and other tall-growing slender herbaceous plants will require support in the way of stakes; they will also need mulching considerably. These plants should receive no check whatever, but should be continued with a regular even growth right through the season. Another desideratum is that the soil should be well drained. Plants of all descriptions thrive far better in well-drained soils, and they require a far less amount of water.

A sharp lookout should be kept on these plants for attacks of red spider; if this insect appears, a good spraying with tobacco solution or benzole emulsion should be given to the plants.

Constant watch will need to be kept for the various small caterpillars that attack the buds of these plants. Spraying with a weak solution of Paris green and lime, or similar insecticide, will be useful; hand-picking should also be resorted to.